THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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ELECTRICITY v. GAS FOR TRAIN LIGHTING.

OF all the uses to which electricity is particularly well adapted, there are few that are more conveniently and appropriately served by that agent than the lighting of railway trains. As we pointed out some years ago, in connection with one of those periodical disasters which cannot be averted even by the utmost exercise of engineering skill and foresight, one of the most valuable attributes of electric lighting for trains is its complete immunity from fire risk. In the instance to which we refer, the horrors of the collision were intensified manifold by a conflagration resulting from the use of gas for lighting the train, which rendered the rescue of some of the victims impossible. It is bad enough to be battered and maimed, without the added torture of roasting to death, before the eyes of one's helpless relatives and friends.

It is almost unnecessary to remind our readers that the inspectors of the Board of Trade have more than once pointed out the dangers of gas lighting, and have strongly recommended the use of electricity for train lighting. In the interests of the passengers, it is to be hoped that at no distant date the Board will insist upon the universal adoption of the electrical system throughout the British railway systems, and we have no doubt that this course will eventually be followed. Unfortunately the Board must wait upon public opinion, which usually is not aroused until some frightful calamity has compelled its attention.

There is another factor, however, which acts much more quickly, and much more effectively, than such considerations as the interests of passengers, the influence of the Board of Trade, or the pressure of public opinion: and that is, the interests of the railway companies themselves. One way of bringing this home to them was recently exemplified in striking fashion on a French railway, where gas was employed as the illuminant. As the result of a derailment, a number of mail vans were set on fire by escaping gas; 12 postal employés were seriously burnt, the mails were completely destroyed, and the vans were reduced to ashes. The value of the registered letters and post-office orders destroyed amounted to more than £24,000, apart from the cost of the vans. On another occasion, two new cars caught fire whilst leaving the depôt, through an escape of gas, and were destroyed; each of them cost £2,800. Thus in a short period the railway company lost £29,600, a loss wholly and solely due to its choice of gas instead of electricity for lighting. The company is liable to suffer similar losses at any time, and it is difficult to realise how any railway manager in his senses can accept this risk for the sake of a slight supposed advantage in running cost, which may or may not be justified by the facts.

Yet, to our astonishment, we have recently learned that one of our most important British railways is contemplating the

wholesale adoption of gas lighting, although it has spent hundreds of thousands of pounds on the installation of electric lighting on its trains. The latter, it is true, was carried out on a system which, though the best of its kind at the time, is now regarded as primitive and wasteful; but to bring the equipment up to date would have been less expensive by far than to scrap the whole system and to substitute gas lighting, to say nothing of the risks which, as we have shown, inevitably attend the use of the latter. What, then, is the reason for this step?

We find that the ostensible cause of the change is the introduction or revival of the system of carrying compressed coal-gas in tanks on the trains; this is rendered possible by the use of inverted mantles, which consume much less gas than the old-fashioned burners, and thus can be supplied from tanks of reasonable size (about 50 cb. ft. for 12 lamps). Hitherto, it has been necessary to use oil-gas, at much greater cost, and apparently it is the possibility of utilising coal-gas, which can be obtained ready-made at any siding, that has attracted the attention and distorted the judgment of the managers.

Leaving on one side the unquestionable advantages of electricity on the score of safety from fire risk, is it the fact that it is inferior to gas in point of cost? We have made it our business to inquire into this question, and have obtained authoritative data as to the actual cost of lighting with compressed coal-gas and inverted mantles, as used upon a certain French railway. Taking the cost of gas at 4s. 6d. per 1,000 cb. ft., and assuming that the mantle maintains its full candle-power throughout its life, the cost per candle-power-hour is about 0·01d. In English towns the cost of gas will be in the neighbourhood of one-half the price given, and this correction would reduce the total cost per candle-hour by one-third; but against this can be set at least an equal falling-off in the average candle-power of the mantle, which leaves the cost per candle-hour, under British conditions, at 0·01d. The weight of the storage tanks and pipes amounts to considerably over a ton for an installation of 12 lamps of 25 c.p. each, and they add some 4 sq. ft. to the transverse section of the coach offering resistance to the air.

On the other hand, using metallic-filament lamps, which have a life about 10 times that of the gas mantles, and maintain their candle-power practically unaltered throughout their lives, and allowing outside figures for the depreciation of plant, interest on capital, maintenance, and cost of additional fuel used on the locomotive, the total cost per candle-hour of an electric lighting system on modern lines does not exceed 0·011d. Charging stations are done away with; any coach can go anywhere, at any time, and no loss of time is incurred in charging. The weight of the equipment for the same duty is less, and the air-resistance is reduced. The lamps, instead of having a minimum candle-power of 25 c.p., can be of 10 c.p., or less, and can be distributed or arranged so as to give the best results, or put in series to give a dim light when passengers wish to sleep. By adopting recent improvements, the cost of the system can be materially reduced below the figure quoted—which, in fact, is in excess of actual results obtained on British trains.

We claim, therefore, that not only for its safety, but also for its economy and convenience, the electric system is far in advance of even the most up-to-date system of gas lighting, and we believe that any railway company that adopts the latter is committing a grave error, which will be remedied only at great cost to the shareholders. In America the tendency to-day is to abandon gas in favour of electricity. We have reason to believe that confirmation of our statements will shortly be forthcoming from an independent quarter of the highest authority, and we strongly urge those responsible for the choice of system to hold their hand until they have absolute proof of the identity of the best system of lighting.

ELECTRIC TRACTION ON BRITISH RAILWAYS.

From time to time considerable attention has been drawn to the remarkable number of railways, both on the Continent and in America, on which electric traction is being applied. Compared with this the British railways, as far as the application of electricity is concerned, appear to have reached a condition of complete stagnation. Leaving out of consideration the "Tube" systems of London, which are, after all, only possible with an electrical system, there is amazingly little work being done or even projected in the electrification of railway lines. The sum total of our achievements comprises some 40 miles on the Lancashire and Yorkshire, about the same on the North-Eastern, 50 miles on the London Underground Railways, 10 miles on the Midland, a few miles on the Mersey Railway, and nine miles on the Brighton system. The adoption of electricity between Liverpool and Southport, which has led to the complete suppression of the steam locomotive, has been attended with conspicuous success, and let it be noted that this is no glorified tramway system, but is a real and live example of electricity applied to fast and heavy traffic. Equally notable have been the results on the section of the North-Eastern system between Newcastle-on-Tyne and Tynemouth. But notwithstanding that every penny spent in these pioneer examples has been amply justified, the railway authorities of the country do not appear to have been influenced in the least degree. No doubt the working results created at the outset a mild interest, but this appears to have been in the main followed by cold indifference, for it must not be forgotten that six years have gone by since the electrical systems were instituted on the two lines mentioned. What is the reason that so little has been done by the railway companies in face of the successes quoted? On all hands the directors of railways record and deplore the falling away of traffics, due, we are told, to the incursions of the ubiquitous electric tramways; but what are they doing to stem the serious inroads into their revenues? Except in two or three cases, we are afraid, the answer is nothing.

For the moment we are in no wise concerned in the application of electricity on main lines; that is a problem too remote for immediate consideration, but we are deeply interested in the possibilities of electricity for local and suburban service, and it is in this direction, one notes with regret, that so little activity prevails. Yet in season and out of season the advocates of electric traction have never slackened in their efforts to establish the fact that only by electrical means was it possible to regain and retain that local traffic which is so easily diverted by the attractions of the electric tramway. We are told that the railway companies are awaiting the results of the single-phase system on the Brighton line before committing themselves to a policy which will entail heavy expenditure. While deliberation is often highly desirable, it is possible to carry it to excess; and in regard to electric traction, we are emphatically of the opinion that the railway companies are not taking advantage of the material which is ready to their hands. Whether the system on the Brighton line is a con-

spicuous success or a comparative failure is quite beside the point. If it proves everything that the introducers claim, it will still be unsuitable for some lines, and should it fall short of anticipations, it would by no means sound the death-knell of single-phase traction. That the Brighton experiment has had a good deal to do with the hesitancy on the part of the railway authorities in this country must be admitted, but we are strengthened in our view that their attitude is unjustifiable by the almost daily developments which are taking place in Germany and the United States on every system of electric traction. In other words, the crystallised experience of other countries is that both single-phase and direct-current systems have their appropriate uses. At any rate, the potentialities of either system do not appear to have curtailed in any way the enterprise of foreign railways with regard to electric traction. In our view, it is just as absurd for English railways to mark time in respect of electrical working for fear of future developments, as it would be for them to decline to carry out extensions on the present system of running rails on account of the possibilities of the monorail. The financial side of the subject, that is, the capital expenditure, has been brought forward as an argument against immediate electrification; it is true that the railway companies of the country are already facing enormous commitments for widenings, stations, and rolling stock, but important though these are, we suggest that none of them is so potent a factor in the future of railway management as a well-conceived scheme of electric traction. The advantages have been written in letters of gold, and not by mere enthusiasts, but by sober-minded managers of railways who are concerned not with the scientific features of electric traction, but with its revenue-earning capacity. For a period there were clamourings for the results of electrification on the Lancashire and Yorkshire and North-Eastern; these are, and have been for some time, open to all the world, but they appear to have made little impression, if we are to judge by the inactivity which exists. We admit that we are laying a somewhat serious indictment at the door of railway directors and officials, but what are we to think when proof upon proof has been offered of the efficacy of electricity, and yet suburban lines show steadily falling receipts?

We have no desire to be misunderstood in our attitude on this subject. It would be idle to suggest that electricity will provide a panacea for all the ills from which suburban and short-distance services suffer, and it would be absurd to think that electric traction can be applied with success under every condition of railway working; but without making any invidious selection, there are, without doubt, many hundreds of miles which would benefit from electrical working. Nor, as we have already indicated, is it necessary to wait for the results of an experiment, which at the best can only prove its usefulness under certain conditions, for again it should be repeated that there has been accumulated during the past six years a vast amount of knowledge on the subject of electrically-operated railways, and these results are at the disposal of those who care to use them.

Now that the Brighton Company's system has been opened for traffic, we hope that even this last excuse for procrastination will shortly be removed, and that the matter will be taken up with energy by the managers of our suburban railway systems, so that the reproach of inertia and vacillation which rests upon them may be dispelled. We venture to suggest that a Committee be formed at as early a date as possible, to go into the whole question and to draw up definite conclusions as to the merits of the respective systems, with a view to clearing the ground for rapid progress in the future.

On Tramway Fares.

A good many small tramway undertakings, and probably some of the larger ones, which have experienced a difficulty in making both ends meet financially, will watch with close interest the experimental use of the "fair fare" system of tramway fares on the B.E.T. group of tramways, which will come into use in the New Year.

The "overlapping stage" system of charging is, like many other things, more in the nature of a practical compromise than anything else, and we question whether any tramway undertaking which possesses adequate earning capacity will be inclined to risk a change unless the travelling public absolutely demand it. The "overlapping stage" system, especially when 1½d. sections are introduced, appears to have met the average case very satisfactorily. The B.E.T. Co.'s undertakings and many small tramway concerns are, however, up against the difficult problem of obtaining that small fractional increase in fare from the passenger which makes all the difference between success and failure; and under these circumstances, a proposal of the kind embodied in the "fair fare" system should be welcomed, even by the travelling public, who, if they pause to consider the matter, must admit that the principle of a fair day's pay for a fair day's work is as applicable to a tramway undertaking as to an individual.

So far as one can judge from the pamphlet issued by the British Electrical Federation, the proposal will benefit many passengers—always assuming that the existing 1d. stages are not seriously altered—and the tramway undertaking will have to rely on the somewhat problematical surplus farthings or checks carried by the passenger, and on his cupidity, to get its own back.

The proposal appears to us in the nature of an experiment, suggested, presumably, by the peculiar conditions existing on the B.E.T. Co.'s lines, but not necessarily ending in their favour. The "fair fare" pamphlet, however, and the reflections which it makes on the "overlapping stage" system of fares, call to mind one real difficulty in connection with the latter, *e.g.*, the matter of through bookings over adjoining systems where the latter afford routes of considerable length.

Such cases exist, although they are not common; and they appear to us to exceed the limit of efficient fare collecting with overlapping stages, especially if the route is at all well patronised and ½d. sections are provided. In a case with which we are acquainted there are some 70 ½d., 1d., 1½d. and 2d. stages, not to mention those for values up to 4d., and this on a 7-mile route; but, as through bookings exist over an additional 7 miles of an adjoining tramway, the task which confronts the conductor can be easily imagined. It seems fairly evident that 6 or 7 miles of thickly-populated route represents the limit with the average conductor, and if extended bookings are necessitated by reason of over-running or transfer junctions, then some other system than that of overlapping stages must be introduced.

The Contract System of Charging.

Thursday evening last week, which saw the opening meeting of the I.E.E.—as regards ordinary business—will be remembered for its business-like procedure and the excellent discussion which took place as a direct result. All credit is due to the new President for his able conduct of affairs, and to Mr. Dykes for his brief and self-denying summary, which allowed ample time for a profitable discussion.

The supply of electricity is a many-sided subject, and, naturally, unanimity of opinion was out of the question, but so far as one could judge from the discussion, the authors made out a very good case for a simple contract system.

After the dismal forecasts which we have heard as to the depredations of the metal-filament lamp, it was quite refreshing to hear Mr. Wilkinson's avowal that at Harrogate during the past seven months the units generated were only 2 per cent. down as compared with a similar period last

year, and this despite the fact that the cream of the business has been obtained. On the other hand, we happen to know of engineers who are not so happily placed, although they admit an increasing lamp connection.

Several speakers apparently misinterpreted the authors' suggestion to let the small (*i.e.*, short-hour) consumer go, and cultivate the more profitable ones, into an intention not to supply the former; any would-be consumer can, of course, demand a supply, even for one lamp, but that does not constitute a reason for hunting up such consumers, to the neglect of more profitable business.

One well-known engineer, who figured prominently in municipal supply work some years ago, expressed his total disagreement with the contract demand system. He considered that a sliding scale was the only equitable system of charge. However, the proof of the value of the authors' and other special systems of charging is surely their ability to attract profitable business; if they can accomplish this they are undoubtedly a commercial asset, which the engineer cannot afford to ignore.

At the time when the authors read their last paper on a similar subject, in April last year, we remember that Mr. Long's assessment tariff was credited with some 800 consumers at Norwich—many of them doubtless merely having changed over—and taking into account the strenuous competition which exists between modern illuminants, it is surely a point in favour of the contract demand system that the authors have been able to arrange for over 10,000 lamps to be supplied under this arrangement in the near future.

A remark by Mr. Hirst as to the benefit accruing to the central station by reason of the reduced power consumption of the metal lamp on peak loads, reminds us that the new lamp can claim credit for the introduction of improvements in plant, such as machine stokers for cheaper fuel, condensers, oil engines for taking peak loads, &c., which would almost certainly have been deferred, or possibly not undertaken at all, unless dire necessity had arisen for economising all round.

Free Apprenticeship in Central Stations.

A good deal has been written lately both in the technical and in the lay Press on the subject of apprenticeships, and there appears to be a desire to revive the old-fashioned kind of apprenticeship, or rather to adapt the old-fashioned apprenticeships to modern conditions. It remains to be seen to what extent the proposal will be successful. Meanwhile the Heston and Isleworth Council, whose electric lighting venture has not hitherto been a conspicuous success, have launched out on original lines of their own. Their proposal, in short, is to offer free apprenticeships, or to give it the more highly sounding term, free pupilships, in their electric light department, to lads attending the secondary schools in their district. We presume that it will be the duty of the chief engineer to father these lads, and to train them up in the way they should go, so that later on they will be able to bud out as fully blown electrical engineers. We do not know if it is proposed to increase the remuneration of the chief engineer for the additional duties involved, but in view of fact that the station will in future be run principally by unpaid labour, we shall watch with interest the future financial results which it is to be hoped will show to better advantage than those hitherto returned.

Business Systems and Economy.

One of the few ideals which business men can find time to cherish is to secure a perfect system for the operation of their own particular business. Much has been said, and rightly so, of the importance of this question. Indeed, the danger now rather seems that, with some people, system amounts almost to a mania, and the results are hardly justified by the means employed. It will scarcely be questioned that the one essential to a good system is simplicity. This being admitted, the actual present state of affairs should be looked at in order to see whether this axiom is always borne in mind.

It is found that while many firms, often those of long standing, use the same system—with little or no modern innovations—as that with which they started, yet there are many more who may perhaps be likened to the alchemists of old, in that they seek something which is more or less a myth. Reform after reform is introduced, our American cousins and their methods are assiduously studied, occasionally too much so, and one scheme after another is rejected in the search for the ideal. At the least the scheme in operation is subjected to endless alteration and supposed improvement. The ostensible objects in view are to reduce the possibility of error, and to obtain an almost automatic effect in the whole routine. Much work is thus often duplicated over and over again, and the first-named object is defeated by the very means adopted to secure it.

Further, to counteract the additional cost of extra staffs, wages are reduced to a minimum, the consequences of which are two-fold. First, the employer obtains an article not altogether satisfactory, because he requires it to be cheap. Secondly, a certain restlessness is invited among employés, which results in the employer having what may be called a "floating" staff. As an instance of this, we have heard of a concern which in four years passed no fewer than 28 men through one of its offices, the normal staff of which is from 10 to 12. The outcome of such a system cannot be described as satisfactory.

Maximum efficiency can only be obtained when a machine runs constantly in perfect order, and, therefore, it seems that when a system is found to be even fairly workable, and at the same time simple, it should be retained. Nothing with any elaborate detail, however carefully supervised, can give better results than a system founded upon a plain fundamental basis. A similar effort should be made to retain the men who give satisfaction, because they are part and parcel of the system. Surely a business with a staff consisting of a small but efficient and responsible body of men is much better than one with a large staff, the units of which go through their routine with much of the automaton about their whole movements. Initiative, which is the soul of business, is in the one case given fair encouragement, and in the other it is stifled and choked by the very atmosphere in which it should thrive.

Electrical Driving of Textile Factories.—The following letter, received as we go to press, further corroborates our unfavourable opinion regarding the Report of the Bradford Committee:—

"As Members of the Special Committee of the Bradford Engineering Society appointed to consider the Electrical Driving of Textile Factories, we desire to protest against the recently published document described as a Report of the Committee.

"Several portions of this document have been published without our knowledge or approval, and without an opportunity being given to the Committee as a whole to discuss it. It does not represent the views of the Committee, and is in many respects misleading.

"The impression that this document gives—viz., of being the outcome of careful inquiries and exhaustive tests, is erroneous; it represents the results of preliminary discussion among the Members of the Committee, and of two tests which were by no means exhaustive.

"We therefore desire to disassociate ourselves from it.

"Yours, &c.,

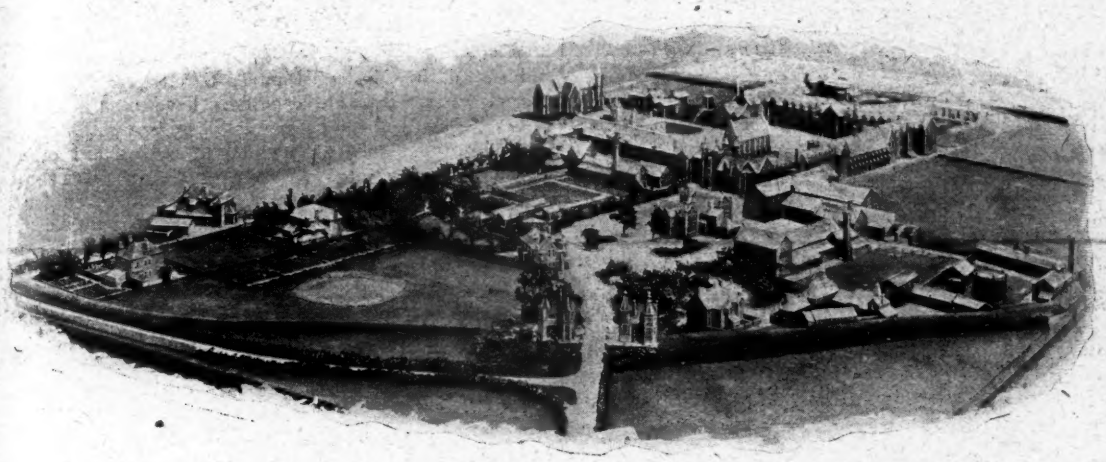
"(Signed) H. Ellis. T. Roles.
H. A. Jones. C. W. Salt.
R. Pohl. W. B. Woodhouse."

ROSSALL SCHOOL LIGHTING.

An interesting scheme has recently been carried out at Rossall School, Fleetwood, Lancs., comprising electric lighting and power, hot water heating, and hot water supply. This installation contains several novel features, including a new system of electric-light wiring and a combination of lighting, heating and hot water supply for the baths, lavatories, &c.

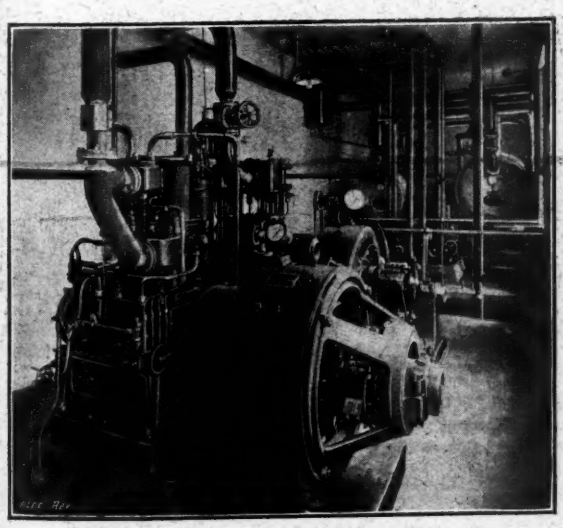
Rossall was founded as a public school in the year 1854, and right up to 1909 was lighted throughout with gas, the same time, the system of gas lighting was also considered most unsatisfactory from several standpoints.

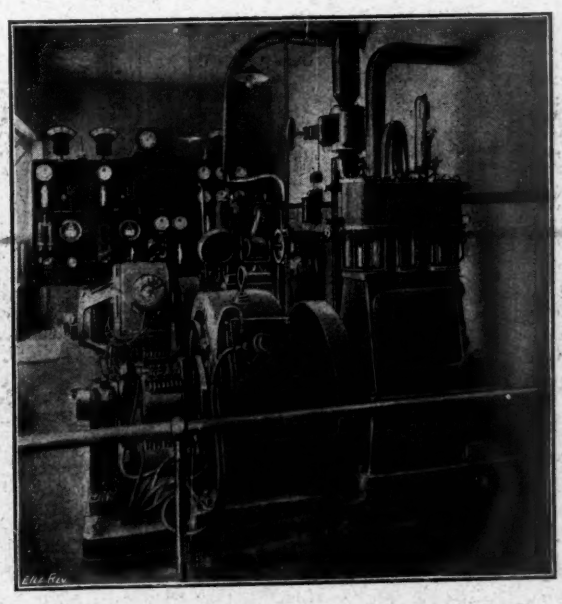
At the beginning of this year the Council considered the question of electric lighting, and retained Messrs. Lacey, Sillar & Leigh, consulting engineers of Westminster and Manchester, to advise fully on the steps which should be taken to render both the heating and lighting efficient. The engineers in their report advised the Council to install a



Bird's Eye View of Rossall School, Fleetwood, Lancs.

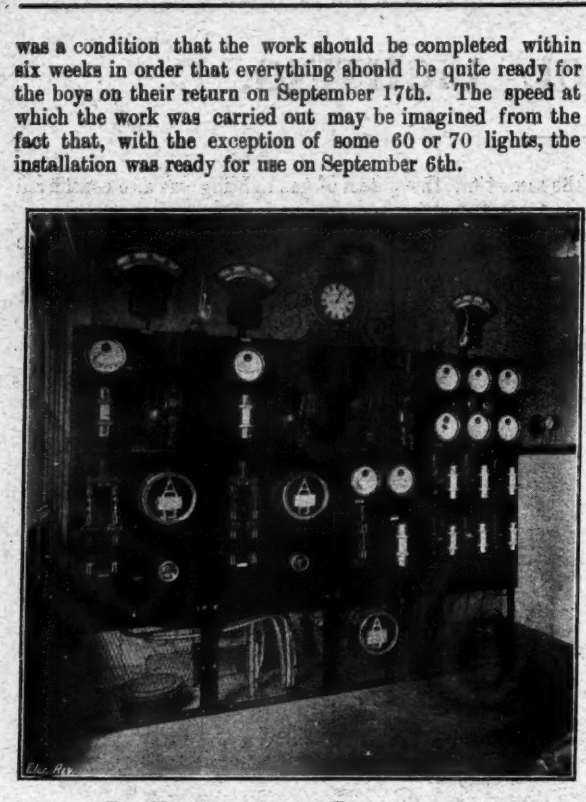
supplied from a private gasworks on the premises. At one time the buildings were heated by steam from a Lancashire boiler (7 ft. × 28 ft.) in the present engine-house buildings, but later on this was superseded by a hot water heating system for the majority of the buildings. Separate heating boilers were put in for this purpose at intervals round the school buildings, and the hot water supply for domestic purposes and baths was taken from back boilers placed in the house room fireplaces. The "gravity" system of heating and hot water supply from back boilers proved, however, to be most inefficient, the amount of coal and coke consumed being enormous in proportion to the results obtained. At steam-driven dynamo for electric light and power which would be supplied with steam from the existing Lancashire boiler, the exhaust steam from the engine being passed into calorifiers for the heating apparatus and hot water supply. The Council adopted this scheme and gave instructions for the preparation of plans, specifications, quantities, &c., for the electric lighting of the whole school, including over 1,500 lights, the necessary generating plant, the pipe mains, &c., for the heating and hot water supply, and all apparatus. Tenders were obtained, and that of Messrs Siemens Bros. was accepted. The contract was placed with this firm on July 22nd, and it





Views in the Engine House, Rossall School.

was a condition that the work should be completed within six weeks in order that everything should be quite ready for the boys on their return on September 17th. The speed at which the work was carried out may be imagined from the fact that, with the exception of some 60 or 70 lights, the installation was ready for use on September 6th.



The Main Switchboard, Rossall School.

The generating plant consists of one 25-KW. steam-driven dynamo, one 25-KW. petrol-driven dynamo, a battery and main switchboard. The steam engine is of the vertical enclosed type by Messrs. Belliss & Morcom, running at 500 R.P.M. The dynamo is a compound wound machine by Messrs. Siemens. The petrol engine and dynamo are of the British Westinghouse Co.'s make, and will be used as a stand-by plant. Both dynamos are direct coupled to the engines. The accumulators comprise 62 cells, by the Chloride Electrical Storage Co., having a capacity of 720 ampere-hours. The main switchboard, of enamelled slate, consists of four panels, one for each dynamo, one battery panel and one feeder panel. Each machine panel is provided with a change-over switch for shunt and compound running. The battery regulating cells are controlled by means of an automatic switch, by Messrs. Bertram Thomas. The governor for this switch is connected to one of the feeder points in the main cable system, and thus maintains the correct voltage on the feeders automatically.

The cable system consists of two ring mains, each ring being supplied by two feeders taken from the main switchboard in the engine house. One ring main runs through the corridors of the masters' houses round the quadrangle, and the other provides for buildings extraneous to the main block, such as the museum, married masters' houses, lodges, cottages, farm buildings, workshops, swimming bath, post office and tuck shop, gymnasium and sanatorium, &c. In each house or building a connection is taken to a switchboard, from which sub-mains are run to distribution boards. The feeders and main cables are paper-insulated and lead-covered, and, where possible, are cleated to the walls of the corridors through which they run. In places where it was necessary to take them underground, paper-insulated and lead-covered and armoured cable was laid direct. The ring main which feeds the buildings, apart from the main quadrangle, consists of bare copper wire run on poles.

The whole of the sub-circuit wiring has been carried out with "Stannos" wire, which has just been put on the market by Messrs. Siemens Bros., and this has been run on the surface of the walls and ceilings. The wire used is No. 3/20 S.W.G., insulated with rubber and covered with a tinned double copper sheath. The outer sheath is used for the return circuit. Special fittings have been provided for the connections at distribution boards, ceiling roses, wall switches, &c. This section of the contract was carried out by the Wardle Engineering Co., as sub-contractors.

In some portions of the school special lighting fittings have been provided. The chapel is lighted by means of standards and corona fittings in real bronze, which were made by Messrs. Veritys. The large school, dining hall, and masters' common rooms are lighted by "Sun" fittings with three lamps each.

The heating and hot water supply section has been installed by Messrs. Dargue, Griffiths & Co., as sub-contractors. Separate calorifiers have been provided for heating and hot water supply. These are installed in the engine house, and are connected to the exhaust pipe from the engine; they also have live-steam connections through a reducing valve. Flow and return pipes are taken from the calorifiers round the school buildings, and these are connected to the existing hot-water pipes in the houses. The longest run for flow and return pipes is approximately 600 yards. The heating apparatus has been connected up to the old heating boilers in such way that the latter can be used, if necessary, as a stand-by. The calorifier and mains for hot water supply are all of copper. The water is circulated by means of two Worthington pumps in the engine house, one for each system. A tank has been fixed in the Clock Tower to act as feed and expansion for both heating and hot-water supply systems, and is connected to the town's mains through a ball tap. The condensed steam from the calorifiers runs through traps to a hot-well, and is used for boiler feed. A grease separator is provided to separate the oil from the exhaust steam.

Interior of the Chapel, Rossall, showing the Tantalum Lighting.

The Lancashire boiler previously supplied steam for an engine which drove the laundry machinery and for the cooking apparatus in the kitchens, &c. It now provides steam for the main generator and for the heating and hot-water supply systems, and therefore, in addition to the work which it has hitherto done, it is providing the lighting and heating of the whole school. The coal which it consumes is only 4 or 5 tons a week more than under the old conditions, and the whole of the gas coal, the coke for the heating boilers and coal for the old hot-water

system are saved. The labour on the gas producers, &c., is also dispensed with, and no extra hands are required in the engine house, since the control of the whole installation is centralised at this point. In addition to the economies which this centralised system has effected, the lighting is most satisfactory, as also is the heating of the schools, and practically an unlimited supply of hot water is provided for baths and domestic purposes.

The whole contract was completed in a most efficient manner, and all the apparatus was in full working order when the boys returned on the first day of the winter term.

His Honour O. L. Leigh Clare, Vice-Chancellor of the Duchy of Lancaster, has personally interested himself in the work throughout, and since they have been in operation has

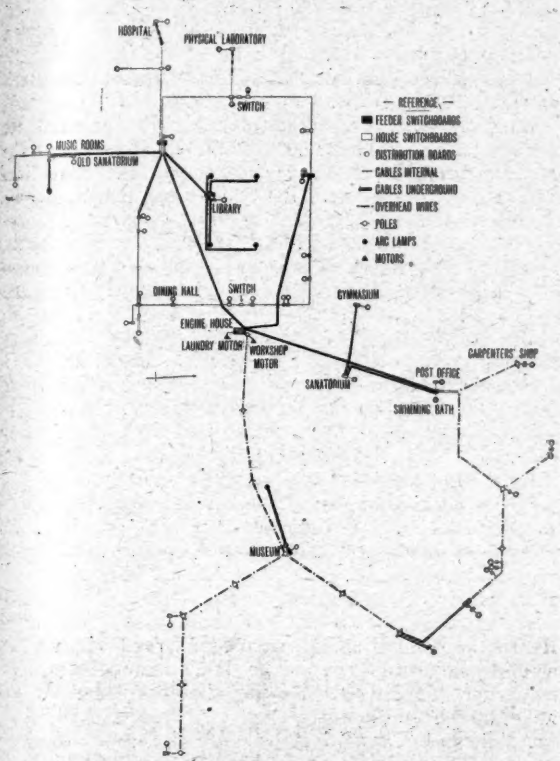


Diagram showing the Electrical Distribution, Rossall School.

taken most careful records of the working expenses. His opinion of the results obtained may be gathered by the following extract from a report recently prepared by him for the School Governors :—

"Assuming the figures in the accounts for 1907 and 1908 to be accurate, the saving should be well over £600 a year with three times the efficiency."

SOME RECENT PATENT CASES.

[FROM A LEGAL CONTRIBUTOR.]

The enormous expense of patent litigation might be expected to cause a falling off in this very important class of business in the courts. But it is not so. Patentees and companies owning patents still seem to find it worth their while to fight things out at length. In the result, the law reports for the past legal year disclose a number of cases which have involved the decision of important principles.

It may be useful to refer to some of the more important of these.

The case of Crosthwaite Fire Bar Syndicate, Ltd., *v.* Senior, 1909, 26 R.P.C., 713, involved an interesting point with regard to a patent for fire-bars. It appeared that in 1900 a patent was granted for "improvements in fire-bars for furnaces." One of the claims was for "constructing a furnace grate of a series of transverse bars, which, when together in position, form tubes or passages through which air or air and steam may be forced and distributed in fan-shaped jets uniformly through the fuel." In 1907 a patent was granted for improvements in the fire-bars, the subject of the patent of 1900. The improvements consisted in forming the bars with the air passages, not, as in the earlier patent, partly in one bar and partly in the next adjacent bar, but wholly in the one bar, the passage being completed by the flat side of the adjacent bar. In an action for infringement of both patents, it was proved that the plaintiffs' bars possessed greater utility, in that they never became so hot as to allow of the adherence of clinker, which result had never been obtained before. The defendants contended that the coolness of the bars was due, not to their special form, but to the fact that they were placed closer together than it had been customary for fire-bars to be placed ; that bars having a form similar to that of the plaintiffs' bars had been used before, and that the invention was wanting in novelty and subject matter. It was held that the patent of 1900 was valid and had been infringed, but that the patent of 1907 was invalid for want of subject matter. On the first patent, judgment was given against two of the three defendants, and the action was dismissed as against the third defendant on the ground that he had not been a party to the infringement. On the second patent, judgment was given against the plaintiffs.

In the case of Bosch's Patent, 1909, 26 R.P.C., 710, the grant of a patent for "Improvements relating to shuttle armatures for dynamos," was opposed on the ground that the invention had been claimed in the specification of a patent of prior date. The Comptroller-General held that a claim, including the making of a shuttle armature of non-magnetic material, should not be restricted to a claim for the materials specified by way of example only, and [following the decision of the Attorney-General in another case] that it included the use of non-magnetisable steel which had been selected by the applicant. The grant was, therefore, refused, and the refusal was confirmed by the Attorney-General. The following principle was enunciated in the case :—"A patent may be granted for selecting the best material, the suitability of which was not previously known, the test being whether the selection involves an invention." It may be mentioned, however, that in a case heard last year (Deutsche Gasglühlicht Aktiengesellschaft's application, 26 R.P.C., 101) it was held that the selection of best conditions for a process may not be subject matter for a patent, when the process has been previously patented.

The case of Thompson's Patent, 1909, 26 R.P.C., c. 673, raised an interesting point as to the power of the Court to grant an extension of a patent. It appeared that in 1888 a patent was granted for a mechanical fuse for causing the explosion of shells, and indicating the number of revolutions performed and distances traversed by projectiles. In 1902 the Privy Council extended the patent for seven years. In the present year the patentee asked for a further extension. The Crown admitted that the invention was meritorious and that the patentee had not been adequately remunerated, but contended that the Court had no power to grant a further extension. This view was adopted by Mr. Justice Parker, and the application was dismissed.

In another case (*re* Johnson's Patent (No. 2) 1909, 1 Ch. 114) Mr. Justice Parker laid down certain rules as to the prolongation of patents which are of considerable interest. Sec. 18 of the Act of 1907 provides that the Court, in considering whether or not the term of a patent should be extended, "shall have regard to the nature and merits of the invention in relation to the public, to the profits made by the patentee as such, and to all the circumstances of the case." The Court must, therefore, consider the nature and importance of the disclosure made in the specification to the public, and for that purpose questions of novelty and subject matter are necessarily material ; and it is the duty of the petitioner for an extension of term to bring to the notice of the Court all that may in any way affect the judgment of the Court in those matters. But if, after hearing the evidence of the petitioner's witnesses, there

is, in the opinion of the Court, a *primâ facie* case for upholding the validity of the patent in respect of novelty and subject matter, the Court need not, as a general rule, investigate the matter, it being always open to an objector to challenge the validity of the patent in proceedings more appropriate for that purpose. Again, for the purpose of considering whether a patentee has been adequately remunerated, profits on his corresponding foreign patents, as well as on his English patents, must be taken into account, and some allowance ought also to be made for profits which will, in all probability, be received in respect of both before their expiration. It is incumbent on a patentee, who petitions for an extension of his patent, to prove that he has done all that he could do to launch his invention on the British market. He ought also to state all facts which are within his knowledge, and which it is obviously material that the Courts should know. Finally, when the Comptroller opposes the extension of a patent on the ground that the trades of this country will, if the patent is prolonged, be put at a disadvantage, compared with the traders of some other country, proper statistics or other information ought to be supplied to the Court as to the nature and extent of the competition which is feared.

Most of the cases which have arisen in connection with the new Patents Act of 1907 have already been fully dealt with in these columns. There is one, however, which seems to deserve special mention. We refer to Kent's Patent, 1909, 26 R.P.C. 666. There an application was made to revoke a patent for mills for pulverising or granulating, on the ground that the patented article was manufactured exclusively or mainly outside the United Kingdom. The patentee did not contend that the machine was not manufactured exclusively or mainly abroad, but urged that there was adequate manufacture, or that there were satisfactory reasons for deficiencies in this respect. At the date of the application one machine had already been made in the United Kingdom; a second machine had been commenced (which was completed shortly before the hearing), although parts of these machines had been imported; and a third had been taken in hand. The present demand in the United Kingdom did not exceed two machines per annum, and the manufacturers here were prepared to turn out 10 or 12 machines per annum if required. The Comptroller-General held that there was a manufacture in this country sufficient to meet the demand, and that sufficient reasons were given for the absence of a more extensive manufacture. He therefore dismissed the application and gave the patentee 30 guineas costs. The following general principle was enunciated: "In revocation cases under Sec. 27 of the Act of 1907, the only question as to price is whether the price charged by a patentee is a *bona fide* one and not adopted for the purpose of checking and diminishing the demand for the article made in the United Kingdom. If the price charged by a patentee for a machine made in the United Kingdom were higher than that charged for a machine supplied from abroad, a *primâ facie* case for suspicion would arise."

The mere use of a patented article may raise a presumption that it is the product of an infringing manufacture. In one case (Saccharin Corporation *v.* National Saccharin Co., Ltd., 26 R.P.C., 654). The owners of three patents relating to processes used in the manufacture of saccharin brought an action for infringement, complaining of eight casks of saccharin which had been imported into England and consigned to the defendants. The price at which it was sold showed that it must have been manufactured by the patented processes. The defence was that the saccharin in question might have been made by processes in respect of which the patents had expired, but the defendants gave no evidence to indicate the source from which the saccharin in question had been obtained. They only said that a guarantee had been given to them that it was not made under the patented processes.

The case of Flour Oxidising Co., Ltd., *v.* J. and R. Hutchinson, 26 R.P.C. 599, is only of general interest by reason of the following extract from the head note to the case which appears in the Official Reports. "It is the duty of the Court not to upset a patent on merely theoretical objections. If there is a statement which may be substantially true, but which is doubted on scientific theory by scientific witnesses, the Court ought to be very careful to be satisfied that the objection made is a real objection, and not merely the opinion of a scientific man, but it is incumbent on the patentee to adduce evidence sufficient to satisfy the Court that there were good grounds for granting him his monopoly."

A REGRETTABLE INCIDENT.

"Uncle Remus," said the little boy, "What's a regrettable incident?"

"Shoah, sonny, you don' know what am a regrettable incident an' youah de fus-bes' scholah in de class? Why, a regrettable incident am a—am like what de German Emperor am always fixin' up, or—see hyar, sonny, I'll tell yo' a story ter show what am a regrettable incident."

The little boy settled himself down with a sigh of content, and fixed his eyes on Uncle Remus's face, as the old negro told the following story:—

B'rer Rabbit, he run de 'lectric light stashun in Pushoe, which am a risin' subbub. One ebenin' he see de eart' lamp go bobbit-bob, an' he don' take no notice, don't B'rer Rabbit. c'ase he see dat before. Den he hear de dynamo go "Oongh"—des like dat—an' he 'llow dat B'rer B'ar he use his 'lectric toofpick. Den de machine go "Oongh!" again, an' B'rer Rabbit he sez, sezee, "Guess B'rer B'ar bin eatin' a berry tough pineapple dis time. He got de seeds in his molar!"

Den de dynamo say "O-oooo-ngh!" an' B'rer Rabbit he jump up offen de stool, an' he say, "My Laws! Dat am a dead short!"

An' den de eart' lamp go bobbity-bobbity-bobbity-bob, an' de dynamo, it say "Oongh-a-oongh-a-oongh-a-o-ooooaaaar!" an' B'rer Rabbit he reckon dat he was in fer trouble. De lights began ter go down an' down, an' de load came up-an'-up-an'-up—an' B'rer Rabbit he screams ter de engine driver, "Fer de Lan's sake, run up de spare set!"

An' w'en he got her in, dere was two of dem bofe saying "Ooongh-a-ooooaaaar!" an' de steam began ter drop, an' B'rer Rabbit he wipe his brow, an' he sez, sezee, "My grashus. Dis am terrible!" So he run round hisself, did B'rer Rabbit, an' he got another engine in, an' he watch all de needles goin' hard over, an' he didn't know what was de matter or where de trouble was, c'ase his system, it was linked up solid ebberywhere.

An' he look down town, he did, an' he see a cloud ob smoke. An' he sez ter hisself, sezee, "I reckon Mis' Goose hes got her fir plantation on fire. Et looks big enough, shoah!"

Des den up comes B'rer Dog in a terrible passhun, an' he shouts, "W'at yoah doin ob, B'rer Rabbit! Shut yoah station down!"

"Wat for?" sez B'rer Rabbit.

"Shut et down, an' don't ask queschuns! Yo' hab blown up de High Street, an' frown a pavin' stone right inter B'rer B'ar's tummy, an' you hab set fire ter B'rer Tarrypin's house, an' its burnin' like billyoh!" sezee.

Den B'rer Rabbit, he run in an ketches holt ob de stop valves, an' it was a massy he did so, fer des den de short went off, an' up went de engines—up an' up an' up—ter six thousan' rebberlooshuns a minute!

Well, sonny, dere was a terrible fuss. Dey tuk it before de p'leece, an' Judge Owl, he sit in de chair, an' all de jury dey look berry indignant, an' B'rer B'ar he giv evidence dat he'd bin hit in de tummy wid de pavin' stone, but dat he didn't bear no malice. But B'rer Tarrypin he carried on terrible. He said dat his 'ouse an' 'ome had bin burnt down, an' his wife an' children were starvin', an' he wanted five hundred pounds outer B'rer Rabbit.

B'rer Rabbit, he say he couldn' help it, an' dat he allus tested fer faults by raisin' glory fire, but de jury dey censure him fer his negligence, an' tell him he was a nuisance, an' dat he mus' pay de five hundred pounds.

An' B'rer Rabbit, he am pooah ter dis day.

"Was the fire the regrettable incident, Uncle Remus?" asked the little boy when he had recovered from the old man's impressive ending.

"Laws, no, sonny! Dat am in de or'nary course ob nature. De regrettable incident was de five hundred pounds.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Corpuscular Theory of Fuses.

It is, doubtless, common knowledge to many of your readers that most incandescent substances emit corpuscles. This is notably the case in the so-called "Edison Effect," where corpuscles are shot off the carbon filament in a glow lamp. Again, in the case of platinum, it is shown that the corpuscles shot off in a unit of time vary with—

$$A\,\theta^{\frac{1}{2}}\,\epsilon^{-\frac{\omega}{\theta}},$$

where θ is the absolute temperature.

Now, according to the corpuscular theory of matter, these corpuscles tend to keep atoms or molecules together, and, accordingly, one would expect that, if such a "law" as above held up to the fusing point, the fusing current would vary with the number of corpuscles emitted, and consequently with $\theta^{\frac{1}{2}}$, provided the factor $\epsilon^{-\frac{\omega}{\theta}}$ was approximate unity.

According to Kempe's Law—

$$C = \frac{\pi}{2}\,\frac{d^{\frac{3}{2}}\epsilon^{\frac{1}{2}}\theta^{\frac{1}{2}}}{s^{\frac{1}{2}}},$$

where d is diameter, ϵ is emissivity constant for the temperature, and s specific resistance.

It would seem, therefore, that there is an intimate connection between the fusing current of a wire, and the "saturation current" for the temperature. Referring to Sir J. J. Thomson's book, "Conduction of Electricity through Gases," page 169, we find the following remarks:—"The emission of corpuscles from the atom must play a very important part in the decomposition of the molecules of a compound by heat, if the forces which bind the atoms together in the molecule, are mainly electrical in their origin."

It appears, therefore, that a fuse disintegrates because its atoms will not "cohere" owing to the corpuscles which bind them being lost.

This leads to an interesting speculation which I hope to deal with elsewhere.

W. H. F. Murdoch.

London, *November 27th*, 1909.

The Steady Job.

With your permission I would venture to offer a little criticism on the article in your issue of the 19th inst. by "A. P. C."

I take it that the essence of his argument may be roughly put thus: If things are made too easy for one, a state of lethargy, mental and moral, is induced, and all valuable effort is choked out of existence.

With this I cannot but agree; all experience of past and present alike tells us that is so, but what I would direct attention to is the extension of the argument into almost a plea for placing each man—for his own true weal—in such conditions that only by the utmost strenuousness may he be assured of a living, and, even then (if his powers are not of the highest) that may be taken from him.

I beg leave to suggest that, however attractive "A. P. C.'s" ably-put case may at first glance appear, his system is not by any means perfect. He, doubtless, is a very acute man, consumed with energy and zeal, and one who will not be denied the giving to the world of his very best. All honour to him. He knows he is one of the best, and this knowledge preserves him immune from any fears as to his means of livelihood, however severe the conditions of life may become. Then he says, "All these men around me who are less gifted than I am, deserve to be spurred up. Their inferiority to me is quite evident, but they shall be given—like the Hebrews of old—no straw, while the tale of their bricks must be undiminished." "A. P. C." would go on (and here I quote his actual words), "some would suffer . . . . some would fall and be trampled on, but the real men (that is, the 'A. P. C.'s') would rise to greater heights."

Now, I venture to say—however much I agree with the hidden kernel of "A. P. C.'s" argument—that all this is on radically wrong lines. No means have yet been discovered of bringing all men up to one standard, and I think it not only right in itself, but in the interests of the State, that different conditions should be allowed different people in the struggle for existence. To advocate one hard and fast set of conditions for all alike, thinking that by the survival of the fittest a millennium of perfection will dawn is, I think, just a misconception of what life should mean.

There are many who may flourish under severe conditions, as they would under almost any other conditions; there are others whose best is produced only under the severe conditions, and who deteriorate when those conditions are relaxed; and there are yet others who, from various causes, may under severe conditions go under altogether, and the good in them (for there is good in almost every man) be lost to the community; they will only flourish under a fostering influence, and where the conditions of life are not the most exacting.

A man may be a wonderful mathematician and a scientific investigator, and yet be of such a highly nervous temperament as to be kept by it far from the fighting line. Apply "A. P. C.'s" system to such a one, and make him fret about the security of his position; the result is he is more or less paralysed, and the best that is in him is lost to the world, and he, poor wretch, is punished into the bargain. On the other hand, the man much less highly endowed mentally but without the nervous disability would come to the top. This, surely, would be the survival of the fittest gone wrong.

"A. P. C." speaks of the sinking of self, and so forth; but, while he condemns one form of selfishness, his remedy appears but the application of another. I venture to say that the whole of his argument rests on a basis of unalloyed selfishness—the curse of modern and ancient times. The idea of killing off the inefficients is nothing new. Ages ago the Roman Parliament had a measure under consideration for ridding the State of those unable to actively serve it. All old men too old to bear arms were to be killed. That was the way the Romans would have settled the old-age pension business. The Roman said that every man unfit to be a soldier, every woman not in vigorous health, every child born deformed, was a burden to the State, or everyone not in sufficient vigour of health to be a producer was a burden to the State, and therefore they tried to pass that law. This was the high-water mark of Roman civilisation, and the Roman then, like "A. P. C." now, was fearful that the weak would hold back the strong. Rome decided the then new doctrines as to strength in weakness, and lived for self, and Rome died. Similarly, I believe, the spirit of commercialism which enthrones self-interest supreme in one's life must, when sufficiently absorbed by the majority, make as surely for our death as a people as did selfishness long ago in Rome.

I hold no brief for indulgence, slackness, and the choosing of the path of least resistance in life, but my contention is that "A. P. C.'s" system is not only wrong *per se* but, in addition, would tend to defeat the very object he apparently has at heart.

P. H. C. Prentice.

London, E.C., *November 25th*, 1909.

I hold entirely with what "A. C. Circuit" says under the above heading, and quite agree with him that "A. P. C.'s" so-called "minor philosophy" is balderdash.

Is it not every right-thinking man's object in life to make suitable provision for himself and his dependents? And, if in his later years he finds the "steady job" the better for that purpose, why should he not apply his earlier experience to his benefit? What is a "steady job" but a position in which experience and sound judgment are necessary qualifications: and if specialisation is valueless, to what are due all our greatest inventions? Certainly not to the gallivanting "jacks-of-all-trades" which "A. P. C." upholds. He says the Government and municipal authorities are particularly bad offenders. I can at least speak for municipal authorities

and assure him that personal keenness and general efficiency are as necessary qualifications in municipal departments as in any other business concern.

Is "A. P. C." confusing the "steady job" with the old "*soft* job?"

J. P. F.

Birmingham.

As I believe you have received further criticisms of my article on "The Fetish of the Steady Job," I shall be glad to have the opportunity of replying to them all at a later date. In the meantime, however, I would ask "A. C. Circuit," whose irresponsible and incoherent letter appeared in your last issue, to read my "pseudo-philosophy" with a little more care, when he will see that he has entirely missed my point.

A. P. C.

November 27th, 1909.

Institution Proceedings.

Hundreds of helpless members like myself must be thanking you for your recent leading articles about the Institution of Civil Engineers. Outsiders have no conception of the way the Institution is managed, and I very much doubt whether our self-elected Council would feel gratified to hear the candid opinion of the members on the subject.

In your issue of to-day you refer to the absurd secrecy about the proceedings. I remember at the last annual meeting, how a member got up, and in a moderate and reasoned speech advocated the admission of the Press. His resolution was duly seconded. That was all. The chairman never put it to the meeting at all, but calmly ignored it. I don't think anyone was surprised; we are used to these little things, particularly after the special meeting previously held to consider the purchase of a new site. You no doubt recollect the circumstances. Nothing in the nature of an explanation of the need to raise the fees was vouchsafed to the members before the meeting, and when some of those present moved that the voting be deferred until the statement of the Council had been communicated to the four or five thousand members concerned, who were not present, this was negatived on account of the urgency of the case. And then we heard that the site could not be purchased at all. The whole thing was a scandal; there is no milder word for it.

The question of the reading or non-reading of papers at meetings is a minor matter. Let us be able to get our papers first. Every other Institution but the Civils hands papers to the members as they enter, but in Great George Street, on the stroke of eight, one of the various assistant secretaries puts down a few papers, often less than a dozen, on the Council table. Then there is a sort of obstacle race over the benches, and the fortunate ones secure a copy at the expense of their dignity, and shins. Surely the Institution can afford a few more copies, and have them presented at the door.

Personally, I have utterly given up hope of reform. Membership of the Institution still has a professional value about equivalent to the subscription, but this is growing less as the activity and vitality of the body increasingly decay. The only chance of reform lies in giving the members the power to nominate members of Council in the same way as the sister Institution at Storey's Gate does. Till we have this, the discredit attaching to the Institution belongs to those who manage it, and not to the members. Meanwhile, Sir, I beg you to continue your good work.

Member.

I would like to endorse your remarks in the leader entitled "Publicity," anent the rule of the Institution of Civil Engineers prohibiting publication; it is equally bad for members as well as the public. I was unable to attend the reading of the papers on "Electric Railways," also the discussion; the result is that I cannot read either the papers or the discussion for at least another three or four months; the *Proceedings* are published quarterly, and are generally some months behind in point of time.

I strongly agree with your correspondents who advocate the sending of proof copies of papers to members in advance as a matter of course, and abolishing the unnecessary waste of time in reading them at the meetings.

I hope the Council will respond to the desire for this reform.

Another Assoc. Mem. Inst.C.E.

I am very glad that you have so strongly called attention once more to the absurd practice of reading papers at the Institution, and so wasting time that might be far better employed in discussion. I entirely agree with your remarks and those of Mr. Farrar, and while on this subject would like to ask why the meetings close at 9.30 or 9.45 at the latest. One would have thought that when an important paper was being discussed the meeting might very well be prolonged to 10.30. This certainly occurred to one when Mr. Rider was unable to make a verbal reply to his critics.

H. Joseph,
Resident Engineer,

Dorking Electricity Supply,
November 29th, 1909.

The First Telephone Switchboard.

Will you kindly inform me: *When* and *where* the first telephone switchboard was erected in *England*?

Mr. Poole states in his book that the *first* telephone switchboard was fitted in Manchester. Until this was pointed out to me I was firmly under the impression that *Coleman Street* held this honour.

W. E. B.

[The exchange at Coleman Street was mentioned in our issue of September 15th, 1879.—Eds. E.R.]

Single-Phase Motors.

Referring to the interesting letters on the above subject, I think the following facts should be brought before your readers to correct a widespread error respecting the flexibility of D.C. motors.

I quite agree that we have alternating-current motors that behave excellently both on full load and when reversed, of which the Bandy motor is a particularly good example.

Mr. A. O. Buckingham, however, is apparently not aware that D.C. motors can be started and reversed on full load without excessive flow of current. I refer chiefly to the well-known Lacy D.C. motor, in which commutator sparking under any load or current within its proper voltage does not exist.

I shall have pleasure in submitting curves showing the maximum current taken by the motor when—

1. Started on full load without external resistance
2. Reversed " " "

if desired, to prove my statements.

The "scrapping" of D.C. plant is surely unnecessary when manufacturers are turning out adaptable motors of this description.

Fred. J. Turquand.

Protection of Tramway Trolley Standards.

In connection with this important question, there is one point which "Inquirer" did not touch upon in his letter to your columns in last week's issue.

Many tramways run with their trolley ropes tied to the car trolley standard, and the removal of the trolley from the wire in the event of the standard being alive becomes still more difficult, if not impossible.

"Inquirer" referred to the dangerous time that might easily elapse before the conductor could get to his back platform and pull down the trolley. A car crowded with passengers in the gangways and the conductor away from his back platform issuing fares explains this.

Consider now the position of the trolley rope being tied to the standard. On the standard becoming alive, a passenger

gets a shock, and immediately there is a panic among the other passengers. The conductor would stand a poor chance of expeditiously getting near the standard. Meantime, the passenger, if held by the shock, is suffering from its effects.

Now assume the conductor can get access to the standard. He has then to untie the rope from the charged standard, and I affirm that there is not one conductor in ten who would tackle this job, assuming that everything is wet.

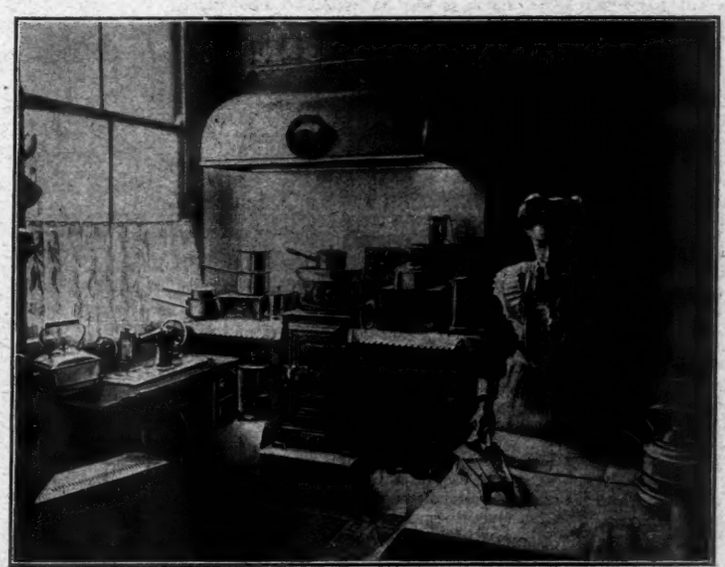
That this would be the case is quite obvious, and to my mind still further emphasises the necessity of adopting such means as will prevent the trolley standard from becoming electrically charged.

P. J. Pringle,
Borough Electrical Engineer and Tramways Manager.

Burton-on-Trent, *November 29th*, 1909.

ELECTRICITY IN THE MODERN HOME.

We congratulate the South Metropolitan Electric Light and Power Co., Ltd., upon the efforts that they are making just now to educate the residents in the newer parts of their wide area of supply in the convenience of electricity in its various applications in the modern home. "Electra House," 111, Bromley Road, has been opened as a model electrical home and it is to serve as a permanent exhibition, with the idea of popularising the use of electricity for all domestic purposes throughout the company's area, but more particularly in the large residential district which is being opened up in the immediate vicinity. The house which is quite new, and occupies a prominent corner position in the main road, forms one of upwards of 2,000 residences of a similar class now being erected on the Forster estate, the rentals ranging from £40 upwards. It contains three reception and five bedrooms, with the usual etceteras. There is no mere show-room effect produced, for the house is actually occupied by a self-denying electrical enthusiast, and every domestic operation where practicable, is carried out by means of electricity, thus saving an enormous amount of work and adding very materially to the comfort and convenience of the occupants. All lighting, heating and cooking, as well as the supply of hot water, is carried out electrically, and there is an electrically-operated vacuum cleaner, flat irons, a sewing machine, boot and knife-cleaning machines, and so forth. No gas or coal will be used for any purpose whatever. Water is heated in kettles and jugs or in larger vessels where a greater quantity is required, while boiling water is available in the scullery, the lavatory, and the bathroom. In addition to the electric ovens, the kitchen is equipped with several electric irons. There are also heaters for large quantities of hot water, hot plates for boiling water, stewing or frying in ordinary utensils, a couple of electric grills and a "Tricity" cooker. A treadle sewing-machine has been converted to electric drive and is in daily use; and in the scullery are electric knife cleaning and boot-polishing machines, as well as an electric geyser for the immediate supply of small quantities of hot or boiling water. Luminous radiators and convectors are in the hall and in every room.



A "Compleat" Electric Kitchen.

In the bathroom a "Therol" water-heater is installed. The "Daisy" electric vacuum cleaner can be connected to any lamp-holder; electric fans are fitted for ventilation; and there are curling-tong and shaving-water heaters, an egg boiler, a coffee percolator, an electric dinner gong, a hat ironer, a bed warmer, cigar lighters, food warmers, hot-water jugs, portable electric lamps, and so forth. A novelty that will doubtless appeal very greatly to the public is a regulating device for turning down the light. Telephones are fitted in every room, while a complete installation of Lowne electric clocks, controlled from a master pendulum in the hall, is being provided for. The lighting throughout is carried out exclusively with the latest forms of metal-filament lamps. The fittings have been chosen to harmonise with the styles of decoration, and comprise a variety of pendants, brackets, floor and table standards, to suit the pockets and requirements of every class of consumer. A special feature is made of Holophane glass reflectors. Visitors can obtain many useful hints as to the most effective and economical manner in which to light their houses. The manufactures of some thirty odd firms are represented in the building, and the installation was carried out by Messrs. Rowland & Hulton, Ltd.

We were afforded the privilege of an inspection of this interesting residence last week, and we are sure that if only the public, as they come to inspect the newly-built houses on the estate with a view to renting them, can be lured into Electra House, they will become useful and satisfied consumers of the South Metropolitan Co. There was no lack of visitors during the closing days of last week, the publicity given to the matter in the Press having made many curious. To our mind the chief problem is that of getting the people to come and see, after that "seeing is believing" and doing too. There must be a spider on the watch for the—well, not the fly, but the probable resident—perhaps that has been arranged with builders' agents and others on the estate; also must there be an aggressive and intelligent effort on the most modern publicity lines. By the medium of these measures the company should have little difficulty in convincing the may-be hesitating visitor of what he ought to do. Let us hope that the existence of a gas-fitted show-house a few doors farther round may help the electricity company,—"Look here on this picture—there on that." The company never has been able to earn more than a merely complimentary dividend on its ordinary stock. In its "untilled soil," if we may so describe the newly-built-on parts of its area, where gas has not got to be "turned out," because it has never been in, we believe there lies one of the great hopes for a prosperous future for the company.

LEGAL.

Stephens *v.* Dowsing Radiant Heat Co., Ltd.

This case came before Mr. Justice Channell and a common jury in the King's Bench Division last week. Miss Mary Jane Stephens, of Russell Road, Crouch End, claimed against defendants to recover damages for injury sustained, as she alleged, by the negligent treatment of the defendants' servants in their administration of the high frequency electrical treatment.

Mr. Marshall Hall, K.C., and Mr. W. Jardine, were for the plaintiff, and the defendants were represented by Mr. Norman Craig, K.C., with Mr. J. E. Walker.

In opening the case, Mr. Marshall Hall said that the plaintiff, who was living with her brother, had occasion to consult Dr. Langford for indigestion. She suggested an electric bath as a remedy for the trouble, and the doctor, consenting, recommended her to go to the Dowsing Heat Co. Miss Stephens went to one of the company's establishments, and the matron suggested that she should not have an electric bath, but the high-frequency treatment instead. This was the system of passing an electric current of high voltage but low amperage through the body of the patient, who had to be placed on an insulated couch; electrodes were placed in her hands, and the electric current passed. The administration was by an apparatus which required the greatest possible care. After again consulting her doctor, Miss Stephens agreed to undergo the treatment, and went to the Dowsing establishment in York Place. There she was placed upon a specially-constructed insulated couch, and the electrodes were placed in her hands. The moment the electricity was applied, she complained of sharp pains in the left instep and the right leg. The nurse, however, did not shut off the current, but merely told the patient there was nothing wrong, and the treatment was continued. On returning home her leg felt worse, and an examination showed that she was suffering from severe electric burns. Acute dermatitis was subsequently set up, and the lady's life was endangered, and she had not yet completely recovered her health. On investigation it was found that the skirt

which she was wearing was trimmed with a tinsel braid which contained a certain amount of metal, through which a contact was created with her body. It was contended by counsel that when Miss Stephens complained of pain, the current should have been shut off, and the operator should have ascertained what it was that caused a normally painless treatment to have an abnormal and painful result.

Miss Stephens, in her evidence, bore out counsel's statement, and said that the pain of the burning was agonising, and she repeatedly complained to the attendant who told her there was nothing wrong. After she had somewhat recovered she went to the manageress of the Institution in which she had been treated, and told her what had happened; and the manageress received her story with incredulity.

Dr. Chas. Harris Langford said that it was he that plaintiff consulted about taking the high frequency treatment; and he consented, knowing that properly administered the treatment was a very good thing.

Dr. Lewis Jones, who said he was in charge of the electrical department at St. Bartholmew's, described the wounds on plaintiff's limbs, and said the burns could have been caused by a circuit connected by means of the metallic filaments in the braid if the dress were lying on the leg as it would be.

If you were administering current and had omitted to see the braid on the first application of the current, what would you have done on notification of intense pain?—I should have stopped the current to see if there was anything wrong.

Normally administered, asked Mr. Marshall Hall, K.C., should there be any pain?—No, and I always warn my patients to tell me if any pricking is felt.

Under cross-examination by Mr. Norman Craig, K.C., Witness said it was not usual to make patients take off their clothes when this "high-frequency" treatment was being administered. Personally, he thought the treatment ought not to be given except in the presence of a medical man, but he knew it was a good thing, and that medical men recommended people to go to these institutions. He agreed that there were differences in individual susceptibility to sparking.

Mr. Norman Craig, K.C., argued for the defence that there was no ground for the charge of negligence against the defendants. A state of things had arisen which it was impossible to understand even now, and which could not have been foreseen.

Nurse Crossfield, who administered the treatment, denied that plaintiff made any complaints of pain as she alleged.

Dr. Wilfrid Harris, of Wimpole Street, said that if you lay a piece of metallic braid on your leg while electric current is passing through the body, there will be sparks, though the braid does not touch earth. He had not been aware of the point until that morning, when he made the experiment. Such sparks were distinctly unpleasant, but not very severe. Under cross-examination, Witness said it was not possible for the braid to have got into contact with the pole in the apparatus.

His Lordship, in summing up, after directing the jury as to the legal aspect of the case, said that the real question was whether the injuries were the result of unavoidable accident or the result of negligence on the part of the operator. It might have been that the lady had unfortunately been the means of a discovery of something in science which was not known before, and if the defendants' agents had not been negligent in their treatment, they could not be held to be liable for the injuries which resulted from it. The defendants had undertaken to administer the treatment to the plaintiff, but in that undertaking they did not guarantee to be successful, nor did they guarantee that there would be no accident. They did not guarantee that something that had never happened before would not happen to the plaintiff. But what they did undertake was to apply proper and reasonable care and proper and reasonable skill. A mere error of judgment would not be sufficient to make them liable in damages, but if they were careless in the use of the process they would be liable. In this case, no one was able to say how the unfortunate accident happened. The lady was at first incredulous about her injuries, and so was one of the doctors, which was only natural under the circumstances. No one was very much inclined to believe at once that something had happened which was contrary to experience, and the jury must not be prejudiced against the defendants by any language which the lady might have used at the time. There must have been some sparking, but nothing which had previously occurred could account for it. It was thought that the metallic braid on the lady's dress had something to do with it, and as to that the jury would have to say whether they thought there had been negligence on the part of the defendants' operator in not having notified that the metallic braid might be dangerous Everybody acquainted with the subject ought to have known that if they had a metallic braid getting into contact with the other pole of the electrical machine they would create damage. There was no evidence that the machine was not of a perfect character or that it was not properly fenced off so as to prevent anything coming in contact with it. There were differences of opinion as to whether the metallic braid might have come into contact with the other pole, and one of the medical witnesses was of opinion that the contact might have produced the sparking, but no one would have supposed that that would have been sufficient to have caused burns such as those from which the plaintiff had suffered.

The jury, after an absence of an hour and a half, returned a verdict for the plaintiff, with £60 damages.

Judgment was entered accordingly, with costs.

His Lordship said there was nothing to complain of with regard to the defendants, the occurrence having been more the result of an accident than anything else.

Rating of Electric Cables.

At Durham Quarter Sessions, before Judge Greenwell, on the 24th ult., an important rating appeal was heard, brought by the Cleveland and Durham Electric Power Distribution Co., against the Assessment Committee of the Lanchester Union, in respect to the rating of electric cables in the parish of Medomsley. Mr. Ryde and Mr. Simey were for the appellants, and Mr. Elliott, K.C., and Mr. Meynell, for the respondents.

Mr. Ryde said the rate appealed against was made in April, 1908, and the appellants were rated at £99 gross, and £82 10s. net, for underground cables and poles for carrying overhead cables at certain parts in the parish of Medomsley, in the Lanchester Union. In form the charge was a very small matter, but the company had taken the appeal as a test case. Originally, it was intended that the whole of the cables should be underground, and they were so laid. It was a colliery district, and subsidences had occurred that had damaged the cables, and, as a result, the cables had to be carried overhead for a great part of the length. In consequence, some part of the outlay by the appellants in laying cables underground had been thrown away. The total outlay on underground cables was £2,522, and of that sum £1,278 was spent on cables now useless and abandoned, and £795 on cables now in use. In substitution for cables disused the company had spent for pole lines, £312; the total cost spent from first to last was £2,834, and the total cost of what was now in use was £1,107. Counsel pointed out that the company in their business of supplying electricity to customers made no profit, but an absolute loss. Quoting cases from the High Courts, he contended that a certain hereditament in a parish, a portion of which was used for profit-making, could only be rated on the profit made. In the present case the company were not making any profit, and, therefore, were not liable to be rated.

Mr. Elliott, for the respondents, argued that if the particular portion of the cable in Medomsley was essential to the working of the whole undertaking, then it was liable to be rated.

The Court dismissed the appeal with costs.

British Westinghouse Co.'s Arbitration.

In the Court of Appeal, Lords Justices Moulton and Farwell had before them on Tuesday, the case of *in re* an arbitration between Coates and the British Westinghouse, &c, Co., on an appeal by Mr. Coates from an order of Mr. Justice Sutton in Chambers.

Counsel, for the appellant, said that the order appealed from was one refusing to appoint an arbitrator under Sec. 5 of the Arbitration Act. An originating summons was taken out for the appointment of an arbitrator under an agreement dated January 1st, made between a company called the Société Anonyme Westinghouse, and the appellant Coates. That agreement provided for the appointment of Mr. Coates as agent for the sale of certain apparatus which that company had the right to dispose of. That contract the foreign company assigned to the British Westinghouse Co., the present respondents.

Lord Justice Moulton said that they could not decide on such an application as that, that there had been a novation. To establish that an action must be brought.

Lord Justice Farwell concurred, and the appeal was accordingly dismissed, with costs.

Tramway Rating.

At Preston Quarter Sessions on Monday judgment was given in the case heard before Mr. Worsley-Taylor, K.C., at Preston on October 21st. The question for discussion was whether or not a length of tramway, rated at £467, should be treated as a railway, and rated as such at one-quarter the full rateable value.

Mr. Sutton had contended that if the Blackpool and Fleetwood Co. was entitled to an exemption, every tramway in the country would be treated as a railway.

Appellants, in 1904, successfully appealed before the Court of Appeal at the House of Lords against the tramroads being rated at full value, and accordingly the tramroad was rated at one-quarter the full rateable value, but respondents continued to rate the tramway at the full value, relying on the decision in 1892, in the case of Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority.

Both parties in the present case, said Mr. Worsley-Taylor, admitted that the Swansea case was binding unless it had been overruled. Appellants contended that it had been overruled by the 1904 appeal, and also by the case of the Wakefield Corporation *v.* the Wakefield and District Light Railways Co. In that case it was held that a straight light railway which was in physical fact distinguishable from a tramway was a railway within Sec. 211 of the Public Health Act. The present case, contended Mr. Taylor, was of very serious importance, for if it was held that the tramway was to be rated at one-fourth only, the decision must govern the rating of the whole of the tramways, and so disturb the basis on which local authorities and tramway undertakings had proceeded since the Swansea case.

The Bench were of opinion that the Swansea case had not been overruled, and the appellants' contention therefore failing, the appeal must be dismissed with costs.

Mr. Taylor consented to state a case.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Wimperis Accelerometer and Gradient Measurer.

Messrs. Elliott Bros., Century Works, Lewisham, are putting on the market a simple instrument designed by Mr. H. E. Wimperis, for indicating by direct reading the rate of acceleration or retardation of the vehicle on which it is carried. It consists of a horizontal copper disk with an eccentric centre of gravity, and controlled by a light spring. Magnetic damping is provided, and the instrument is so compensated that accelerative forces in any direction but that under test are neutralised. It can be used for a variety of measurements, including the tractive effort of locomotives or motor cars, brake horse-power when running, the value of gradients, &c. When measuring the acceleration due to the driving force, the reading is independent of the effect of gravitational forces.

Igranic Pillar-Type Panels.

A new series of ironclad motor-panels has been brought out by the Adams Manufacturing Co., Ltd., of Bedford, some of which are illustrated herewith. Fig. 1 shows a panel equipped with motor starter, shunt regulator, ammeter, and D.P. circuit-breaker. The starter is of the sliding-contact type, and can be provided for ordinary starting duties up to 35 H.P. at 100 volts, and 50 H.P. at 200 to 500 volts, or with a heavy-duty starter up to 60 H.P. at 100 volts, and 100 H.P. at 200 to 500 volts. The circuit-breakers are interlocked with the starter, so that the circuit is always made and broken on the easily renewable sparking contacts provided with them. These are protected by powerful magnetic blow-outs, thus reducing the sparking to an absolute minimum at these times. Further, the interlock is such that should the circuit be opened through failure of voltage, excess load, or any other cause, it is impossible to reclose it until all the starting resistance is first reinserted in the motor circuit.

The switch parts are mounted on substantial slate bases, fitted to an angle-iron frame, which is in turn totally enclosed in an iron housing, provided with cast-iron top and base, and with glazed doors over the front of the apparatus and inspection doors at the back, so that the resistance can be examined with ease.

The circuit-breakers have not to be operated by means of a separate handle, but at the same time they give exactly the same effect as the ordinary loose-handle circuit-breaker. The first movement of the contact lever completes the circuit of the coil which operates these breakers, and thus causes them to close.

Figs. 2 and 3 illustrate a somewhat similar type of panel, with slow-speed worm gear. This is not really an essential feature when the circuit-breakers with overload are provided, for if the starting resistance were cut out too rapidly, the consequent excess current flowing through the armature would cause the overload device to trip the circuit-breakers and necessitate the starting lever being brought back to the initial position before the circuit could again be closed. Adjustment of the overload, therefore, can be made to limit the speed of cutting out the starting resistance. When, however, it is desired to have this additional refinement, it can be fitted with a step-by-step motion, which, by a continuous rotary movement of the operating lever, causes the contact lever to jump from step to step, giving a slight pause on each.

Catalogue "B" illustrates and describes a few of the standard types of panels, but they can be made to give any combination that may be required.

The "Torque" Banding.

An improved system of banding for lathes and machine tools has been put on the market by the patentee, Mr. C. McD. Cheeld, Hilltop Works, Thorpe-le-Soken, Essex. It consists of stranded cord, dressed with compound, and provided with a novel and ingenious fastener, as illustrated below. The head on the end of the hook is inserted between the strands, and the wire ring is then compressed tightly over the strands round the neck of the fastener, making a permanently secure and neat connection between the cord and the fastener. A great advantage claimed for this banding is that, by twisting the cord before hooking the fasteners together, the cord can be lengthened or shortened over a range of 1½ in. to the foot, giving great facility for adjustment to suit stepped pulleys or to take up slack. The fastener is no larger than the cord, so that it runs easily over the pulleys.

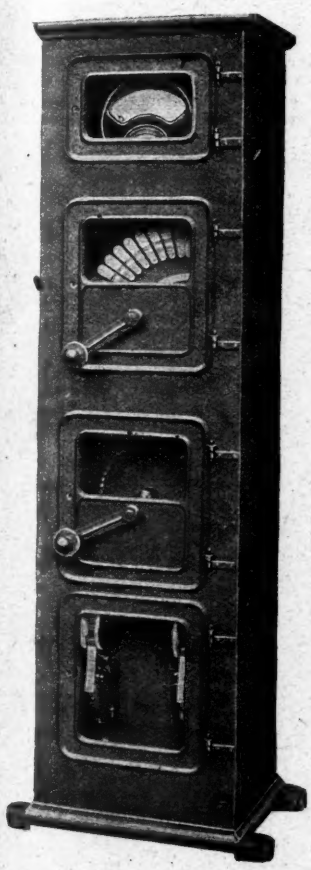


Fig. 1.—Starting and Regulating Panel.

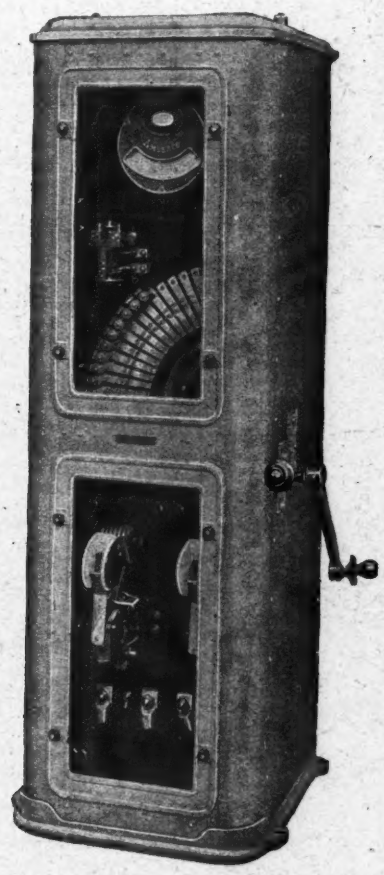


Fig. 2.—Starter with Slow-Speed Gear.

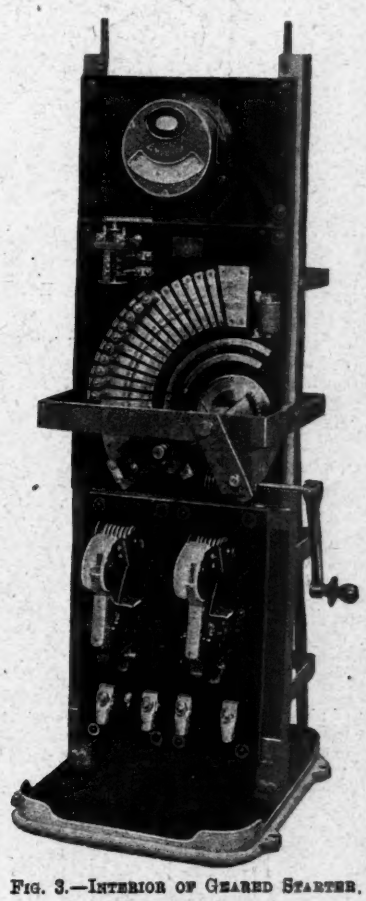


Fig. 3.—Interior of Geared Starter.

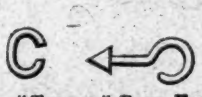


Fig. 4.—"Torque" Band Fastener.

Dugdill's Shade Fixer.

A simple device has been brought out by Messrs. John Dugdill and Co., of Failsworth, Manchester, for holding the shade-ring when fixing a shade on a lamp-holder. The difficulty of this operation has been greatly increased by the adoption of specially deep shades with metallic-filament lamps, rendering the use of such an

implement almost unavoidable. The shade fixer is practically a pair of tongs, with specially shaped jaws which fit any of the

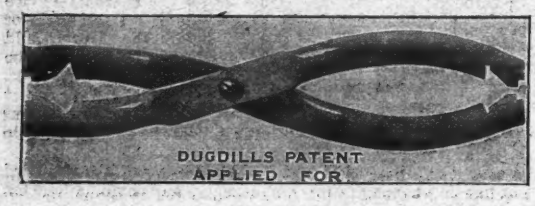


Fig. 5.—Dugdill's Shade Fixer.

standard lamp-holders; it can also be had double-ended, as shown, the second pair of jaws being made to fit miniature lamp-holders.

The Wilkinson Economic Electric Stove.

An ingenious electric stove has been devised by Messrs. F. A Wilkinson and Partners, Ltd., of Harpenden, Herts., the construction of which is of extreme simplicity. The body consists o

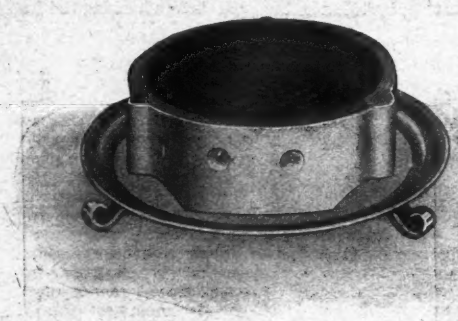


Fig. 6.—Wilkinson Economic Stove.

an earthenware cylinder, into which the other parts—a plain disk, and a block with a spiral groove formed in its surface, both of earthenware—are laid. In the groove is the heating element, a spiral

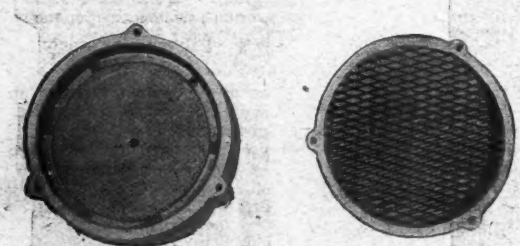


Fig. 7.—Body and Cover of Stove.

of nickel or other wire, and the terminals come opposite holes in the outer cylinder. Over the heating element is laid a grating of expanded metal, held in place by a polished ring and three screws.

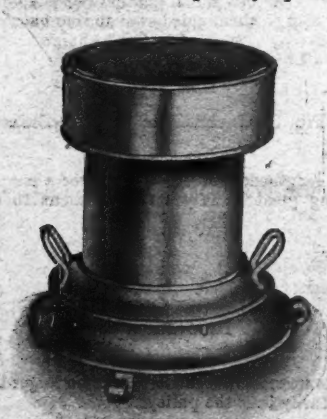


Fig. 9.—Heating Element.

Fig. 8.—Combined Radiator and Stove.

The whole can be mounted on an aluminium tray as shown in fig. 6. The stove is suitable for boiling, toasting or frying with ordinary household utensils, or it can be inverted and used for grilling. The heating element attains a bright red heat, and has a life of 1,000 hours; it can be renewed at small cost, and is made for any voltage

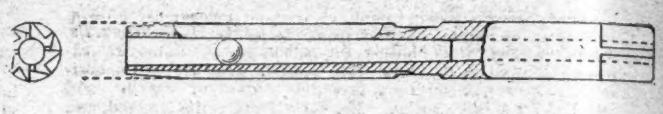


Fig. 10.—"Loewe" Expansion Reamer.

from 100 to 250 volts, A.C. or D.C. The stove is also available for use as a radiator, and can be mounted in an aluminium stand as a combined radiator and stove (fig. 8). The special features of the device are its small cost, high efficiency, and facility for cleaning—all the parts can easily be dismounted and washed. It should be extremely useful in connection with the cooking and heating campaign that all progressive station engineers have begun or are contemplating.

The "Loewe" Expansion Reamer.

A neat expansion reamer is being put on the market by Messrs Ludw. Loewe & Co., Ltd., 30/2, Farringdon Road, E.C. As will be gathered from the section, fig. 10, the expansion is produced by a hardened steel ball in the taper bore; the grooves have longitudinal slits to give the necessary elasticity. The reamer can be expanded at any particular point, or (by using two or more balls) over a greater length. As the bore is taper, it is easy to remove the balls. The reamers are made to standard sizes from $\frac{1}{16}$ in. upwards, and, owing to their simple construction, are inexpensive.

TRADE STATISTICS OF BRITISH INDIA.

The following figures, showing the imports of electrical and similar materials into India during the year ended March 31st, 1909, are taken from the recently issued official trade statistics; the details for the year ended March 31st, 1908, are added for purposes of comparison, and notes of any increases or decreases are given:—

15 rupees = £1.

	1907-8. Rupees.	1908-9. Rupees.	Increase or decrease. Rupees.
Lampware.—			
From Great Britain ...	10,15.000	10.92.000	+ 77.000
„ Germany	6.41.000	5 55.000	— 86.000
„ Austria	5.62.000	4.42.000	— 1.20.000
„ United States ...	3 08.000	2 67.000	— 41.000
„ Other countries ...	1 63.000	85.000	— 78 000
Total ...	26 89 000	24.41.000	— 2.48.000
Other hardware, except enamelled ware —			
From Great Britain ...	1.42.03.000	1.39.71.000	— 2.32.000
„ Germany	30.50.000	22.74.000	— 7.76.000
„ Belgium	11.62 000	10.69.000	— 93.000
„ Austria	3.38.000	2.91.000	— 47.000
„ United States ...	7.57.000	6.88.000	— 69 000
„ Other countries ...	7.53 000	7.57.000	+ 4 000
Total ...	2.02 63 000	1.90 50.000	— 12.13.000
Brass, wrought.—			
From Great Britain ...	7.15 000	7.05.000	— 10.000
„ Germany	1.23.000	2.51.000	+ 1.28.000
„ Austria	82 000	70.000	— 12.000
„ Other countries ...	3.68.000	2.06.000	— 1 62.000
Total ...	12.88 000	12.32.000	— 56 000
Copper and copper ware.—			
From Great Britain ...	1.43.66.000	1.71 97.000	+ 28.31.000
„ Germany	33.47.000	52 67.000	+ 19.20.000
„ Belgium	4.56.000	18.05 000	+ 13.49.000
„ Italy	3 98.000	4.37 000	+ 39.000
„ Austria	1.22.000	1.70 000	+ 48.000
„ Japan	16.68 000	20.36.000	+ 3 68.000
„ Other countries ...	2.78.000	3.02.000	+ 24.000
Total ...	2 06.35.000	2.72.14.000	+ 65.79.000
Iron wire.—			
From Great Britain ...	1.61.000	1.33.000	— 28 000
„ Germany	1.08 000	54.000	— 54.000
„ Belgium	6.77.000	3.82 000	— 2.95.000
„ Other countries ...	1.30.000	1.09.000	— 21.000
Total ...	10.76.000	6.78.000	— 3.98 000

	1907-8. Rupees.	1908-9. Rupees.	Increase or decrease. Rupees.
Steel plates and sheets.—			
From Great Britain ...	89.79.000	75.59.000	— 14 20.000
„ Germany	12.34.000	21.30.000	+ 8.96 000
„ Austria	22 61.000	27.91.000	+ 5.30.000
„ Other countries ...	22.000	24 000	+ 2.000
Total ...	1,24.96.000	1.25.04.000	+ 8.000
Steam engines (except locomotives).			
From Great Britain ...	1.21.43.000	96 38.000	— 25.05 000
„ Belgium	2.73.000	1.25.000	— 1.48.000
„ Other countries ...	2.07.000	3.29.000	+ 1.22.000
Total ...	1.26.23.000	1.00.92.000	— 25 31.000
Electrical machinery.—			
From Great Britain ...	23.28.000	30.43.000	+ 7.15.000
„ Germany	94 000	64.000	— 30.000
„ Belgium	2.41 000	38.000	— 2.03 000
„ Italy...	57.000	68.000	+ 11.000
„ U.S A.	2 16.000	2.92.000	+ 76.000
„ Other countries ...	35.000	42.000	+ 7.000
Total ...	29.71.000	35.47.000	+ 5 76.000
Mining machinery.—			
From Great Britain ...	7.27 000	11.84 000	+ 4.57.000
„ Germany	41.000	2.000	— 39.000
„ U.S.A.	7.000	50.000	+ 43 000
Total ...	7.75.000	12.36.000	+ 4.61.000
Machinery, other (except textile and agricultural).—			
From Great Britain ...	1.99.56.000	1.87.08.000	— 12.48.000
„ Germany	8.15.000	8.96 000	+ 81.000
„ Belgium	2.88.000	9 54 000	+ 6.66.800
„ U S.A.	7.90.000	8.40.000	+ 50.000
„ Other countries ...	2.03.000	3.20.000	+ 1.17.000
Total ...	2.20.52.000	2.17.18.000	— 3.34.000
Railway carriages, &c.—			
From Great Britain ...	3.09 24.000	3 85 55.000	+ 76.31.000
„ Belgium	4 28.000	7.30.000	+ 3.02.000
„ Other countries ...	1.20.000	65.000	— 55.000
Total ...	3.14.72.000	3.93.50.000	+ 78.78.000
Locomotives and tenders, and parts thereof.—			
From Great Britain ...	1.74 49.000	1.37.35.000	— 37.14.000
„ Germany	30.000	24.000	— 6 000
„ Other countries ...	14.000	25.000	+ 11.000
Total ...	1.74.93.000	1.37.84.000	— 37.09.000
Rails and fishplates.—			
From Great Britain ...	80.59.000	1.07.23.000	+ 26.64.000
„ Germany	2.57.000	3.34.000	+ 77.000
„ Other countries ...	4.00.000	2.32.000	— 1.68.000
Total ...	87.16.000	1.12.89.000	+ 25.73.000
Glass lampware.—			
From Great Britain ...	1.10.000	91.000	— 19.000
„ Germany	3.96 000	2.49.000	— 1.47.000
„ Austria	2.72.000	2.29.000	— 43.000
„ Other countries ...	1.30.000	93.000	— 37.000
Total ...	9.08.000	6.62.000	— 2.46.000
Electrical instruments, apparatus, &c.—			
From Great Britain ...	44.30.000	42.25 000	— 2.05.000
„ Germany	1.95.000	1.68.000	— 27.000
„ Belgium	96 000	63.000	— 33.000
„ Austria	45 000	19 000	— 26.000
„ United States ...	1.12.000	80.000	— 32.000
„ Other countries ...	30.000	27.000	— 3.000
Total ...	49.08.000	45.82.000	— 3.26.000
Scientific, &c., instruments.—			
From Great Britain ...	12.61.000	15.17.000	+ 2.56.000
„ Germany	46.000	1.02.000	+ 56.000
„ United States ...	56.000	56.000	—
„ Other countries ...	78.000	1.48.000	+ 70.000
Total ...	14.41.000	18.23.000	+ 3.82.000
Telegraph construction materials.—			
From Great Britain ...	28.000	1.23.000	+ 95.000
„ Other countries ...	1.000	8.000	+ 7.000
Total ...	29.000	1.31.000	+ 1.02.000

In addition to the foregoing, the following were imported as Government stores:—

	1907-8. Rupees.	1908-9. Rupees.	Increase or decrease. Rupees.
Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	16.82 000	20.20.000	+ 3.38.000
„ Germany	22.000	2 000	— 20.000
„ United States ...	29.000	8 000	— 21.000
„ Other countries ...	7.000	5.000	— 2.000
Total ...	17.40.000	20.35.000	+ 2.95.000
Machinery.—			
From Great Britain ...	26 06.000	37.21.000	+ 11.15.000
„ Germany	79 000	54 000	— 25.000
„ United States ...	5.000	57.000	+ 52.000
„ Other countries ...	16.000	2.000	— 14,000
Total ...	27.06.000	38.34.000	+ 11.28.000
Iron wire.—			
From Great Britain ...	3.52.000	76.000	— 2.76.000
Steel plates and sheets.—			
From Great Britain ...	10.49.000	7.20.000	— 3.29.000
„ United States ...	—	1.000	+ 1.000
Total ...	10.49.000	7.21.000	— 3 28.000
Railway carriages.—			
From Great Britain ...	90.34.000	2.57.93.000	+ 1.67.59.000
Locomotives.—			
From Great Britain ...	82.50.000	1.10.44.000	+ 27.94.000
Rails.—			
From Great Britain ...	56.69.000	37.59.000	— 19.10.000
„ Canada	—	3.32.000	+ 3.32.000
„ Belgium	18.000	—	— 18.000
Total ...	56.87.000	40.91.000	— 15.96.000
Telegraph construction materials.—			
From Great Britain ...	15.22.000	9.46.000	— 5.76.000
„ Belgium	49.000	4.000	— 45.000
„ Other countries ...	1.000	1.000	—
Total ...	15.72.000	9.51.000	— 6.21.000

THE CARE AND WORKING OF ECONOMISERS.

[COMMUNICATED.]

The Green's type of fuel economiser is nowadays universally used in connection with the Lancashire boilers employed at large electric power stations, but, notwithstanding its extended use in this connection, much ignorance exists on matters affecting its maintenance and upkeep, and many points are frequently overlooked in regard to its working, the neglect of which at times involves considerable risk, if not actual danger.

Fuel economisers, like steam boilers, are very liable to deterioration, unless carefully and skilfully attended, to both when at work and at rest. It is a great mistake to suppose, as many do, that serious explosions cannot occur with them. The vertical pipes, it is true, owing to their small diameter, are capable of withstanding high pressures, but being of cast-iron, they are not unduly strong, and when it is remembered that they become corroded both externally and internally, it will be at once apparent that they may become so thinned and weakened in course of time as to be quite unable to withstand the pressure to which they are exposed. An economiser full of water at a temperature of about 300° F., contains a vast amount of potential energy. Should there be any sudden escape of water and consequent reduction of pressure through the failure of a single pipe, the water would, to a large extent, instantly flash into steam, the shock of which might be sufficient to rupture other pipes until the whole of the economiser was blown to pieces. More than one disastrous explosion has occurred in this way, illustrating the danger to which these vessels are liable, and hence the great importance of regular attendance and inspection, and a proper knowledge of the correct methods of working.

External corrosion is probably the most common form of deterioration of fuel economisers, and it is usually brought about in the following way :—

The comparatively cold feed at the inlet end of the economiser keeps the bottom boxes and the lower parts of the pipes cool. As the hot gases come into contact with the cold surfaces, the vapour they contain becomes condensed on the cold parts and leads to external wasting. If the fuel used contains much sulphur, sulphur dioxide and sulphur trioxide will be present in the products of combustion. These gases, in combination with water, form sulphuric acid, which has a most powerfully corrosive action on the metal surfaces, and causes very rapid wasting.

The lower the temperature of the entering feed water, the greater, of course, will be the accumulation of moisture, and consequently the extent of the wasting of the pipes and bottom boxes. For this reason, the feed water should not be allowed to enter the economiser at a temperature of less than 90° F.

If the temperature before entering be raised to 100°, trouble from external wasting is not likely to be experienced to any serious extent, although, in some instances, much wasting has occurred when the temperature has been raised to as much as 120°.

Some coals contain a large percentage of moisture, and where such fuels are used it is important that the temperature of the feed water be raised well above 90° before being passed into the economiser.

When the pipes are found to suffer from external wasting, it is advisable to raise the temperature of the feed water before it enters the economiser, even if this is already as high as 100°. Generally, however, when external corrosion is taking place, although the temperature is above 100°, a special investigation ought to be made, as it is probable that some other cause is responsible for the mischief.

Leakage at the various parts will sometimes lead to external wasting of the pipes and boxes. When any part is found to leak, it should be given immediate attention. If, for instance, leakage takes place past the cap joints, these should be remade at the first opportunity. The cap bolts must not, under any circumstances, be tightened up whilst the economiser is under pressure. Only recently a man was killed in doing this when the economiser was at work, the cap being blown violently into his chest.

Special care must be taken to prevent moisture getting into the flues, the soot pit, or any part of the setting, as this, especially when present about the seatings, is very liable to set up external corrosion. Waste water from any of the valves, for example, should not on any account be allowed to drain into the flues or soot pit, but should be carried well away from the economiser.

The action of the scrapers is also responsible for wearing away the outer surfaces of the pipes in course of time.

Usually the lower ends of the pipes and the bottom boxes at the inlet end of the economiser will be the parts most severely wasted, as it is at these parts that the feed water is coldest, and the condensaton therefore greatest. The extent of the wasting may be ascertained by callipering the remaining external diameter of the pipe.

Economisers also become wasted by internal corrosion when the feed water is corrosive. Unfortunately such wasting is very difficult to detect, as a satisfactory examination cannot be made owing to the small diameter of the pipes.

All that can be done in the way of making an inspection for the purpose of detecting internal corrosion is to lower a lighted candle down the pipes, after first clearing these of scale and deposit. When it is suspected that much wasting has taken place internally, it will be necessary to ascertain the remaining thickness of metal, especially if the parts are also externally wasted. This may sometimes be done by callipering the inner and outward diameters of the pipes. A better plan is to drill a hole through the wasted part, so that the actual thickness may be seen. In really bad cases, it may be desirable to withdraw a pipe and break it up, in order that some idea of the general condition of the economiser can be obtained. An hydraulic test is sometimes advisable, the test pressure which should be applied being from one and a half times to twice the ordinary working pressure.

Where the caps opposite the top ends of the pipes are of the external pattern, it will be necessary to regularly examine the bolts and cross-bars, as these gradually become weakened by internal wasting.

The Board of Trade now recommend that each vertical pipe be inspected once each year, as well as each cap bolt where the external caps are provided. It is not sufficient to examine only a few pipes annually, and from these judge the condition of all others. It is, of course, seldom practicable to open out all the pipes at one time, and in such cases the engineer-in-charge should make a practice of removing a certain number of caps each week or each month, making sure that the whole of the pipes have been inspected during the year.

It is most important that the tubes be kept well cleaned and scraped both on the fireside and the water side. Soot is a very bad conductor of heat, so bad, in fact, that it is sometimes used as a non-conducting covering, and if allowed to accumulate on the outer surfaces of the pipes it materially impedes the transmission of heat from the furnace gases to the feed water in the economiser, leading to inefficiency in working. Hence the scrapers must be kept in good working order, any broken ones being renewed without delay. They should be made to traverse almost the whole length of the pipes.

Similarly, if scale be allowed to accumulate inside the pipes, the efficiency becomes impaired. Accumulations of scale are objectionable also because they lead to overheating, followed in some instances by fracture of the pipes. Hence each pipe should be regularly washed out, the length of time which should be allowed to elapse between each cleaning time depending on the amount of scale-forming matter contained in the feed water. The economiser should also be blown off by opening the blow-out tap for about a minute each day, so that any sediment in the bottom boxes will be blown out. The opening of the safety valve, which should be done every day for the purpose of testing and seeing that it discharges freely, also removes sediment from the upper parts of the economiser. The scale ought never to be allowed to accumulate to a greater thickness than $\frac{1}{8}$ in.

Leakage of air into the flues is a common cause of inefficient working, for every pound of cold air introduced into the flues, carries away with it a certain amount of useful heat. It is, therefore, important to frequently examine all parts where there is any possibility of air passing into the flues. The leakage may be tested by means of a lighted candle, the flame of which is drawn inwards with the air.

It is advisable to regularly examine the working parts of the economiser, so that defective working may be detected and remedied.

Grease must be kept away from the chains to prevent these slipping on the pulleys.

Every fuel economiser ought to be provided with two thermometers, one on the inlet pipe and one on the outlet pipe. By means of these the efficiency of working may be tested. When the difference of temperature between the inlet and outlet water is found to fall, the economy is being reduced for some reason, and an examination should be made to ascertain the cause. A fall in the temperature difference of 10° F., means a loss in economy of approximately 1 per cent. It is, of course, necessary to observe the thermometer readings frequently.

In some of the old types of Green's economiser having external caps resting on conical seats, difficultly was often experienced in loosening the caps from their seatings. Efforts to do this have in many instances resulted in fracture of the top boxes. The operation is a somewhat difficult one, and should always be carried out carefully.

The working of fuel economisers, as already remarked, is attended with many dangers, to avoid which certain precautions are necessary.

One of these is the liability to flue gas explosions. The top of the economiser chamber is situated above the level of the dampers, and hence there is a tendency for explosive gases or mixtures to accumulate there.

The explosions are brought about in the following manner : When the fires are banked at stopping times, unconsumed coal gas is distilled from the coal, and passes along the flues, collecting in the top of the chamber. When the fires are again broken up a quantity of air is admitted, which passes

along and mixes with the unconsumed coal gas, thus forming an explosive mixture.

The breaking up of the fires causes the flames to ignite the mixture, a flue gas explosion being the result.

Flue gas explosions have been responsible for several disastrous economiser explosions. The shock produced when the mixture explodes has been sufficient to break some of the cast-iron pipes, which in turn have led to other pipes fracturing, until the whole economiser has been blown to pieces.

To avoid the accumulation of explosive mixtures after the boiler has been standing with banked fires, the dampers should be opened for a short time before stirring up the fires.

This allows a quantity of air to sweep through the flues and carry away any accumulated gas, so that an explosion is then impossible.

Flap doors are sometimes fitted into the top of the chamber, which open in the event of a flue explosion, and minimise the severity of the shock.

Much danger is incurred whenever the water is allowed to remain stationary in the pipes whilst the hot gases are passing through the economiser flues. When this is the case, the water gradually gets hotter until steam is generated. The level of the water in the pipes becomes lowered, allowing the latter to get overheated and so seriously weakened that fracture is very liable to follow. In addition to this, there is the danger of "water hammer" action taking place, which occasionally bursts the top feed pipe. The steam formed in the pipes comes in contact with the water on the other side of the outlet valve from the economiser when the valve is opened, thus causing the water hammer action.

When steam is being raised first thing in the morning, the water will be stationary in the economiser if the engine and the feed pump have not been started.

Should the hot gases be passed through the economiser flues, danger will be incurred in the manner indicated. To avoid this danger, the products of combustion should always be passed through the by-pass or reserve flue until the pump is started and the water set in motion. This prevents the formation of steam in the pipes through the economiser becoming too hot.

Irregular feeding should be avoided as far as possible. Where, however, it is necessary to work an economiser intermittently, a portion of the hot gases should be passed through the reserve flue to minimise the risk of the water being evaporated into steam.

Steam ought never to be allowed to form in the pipes. Apart from the danger which it involves, much difficulty will in all probability be experienced in feeding the boiler, as the steam forms a cushion against which the water has to be forced. The economiser outlet valve should not be closed during the night time.

Although it is generally found necessary to load the safety valve on the economiser to a higher pressure than that on the boiler, owing to the pressure caused by pulsations of the pump, or water ram action, &c., yet it should not be loaded so much in excess of the load on the boiler safety valve as is sometimes found to be the case.

It is common knowledge that a valve to resist water pressure generally requires a heavier weight than would be required to resist steam pressure of the same intensity. It is probably this fact which accounts for the excessive loading of economiser safety valves occasionally met with. The loading should not be more than 20 lb. above the boiler safety valve load, though it is not uncommon to find it nearly twice as much. If the valve leaks the remedy is to re-grind it, instead of putting additional weights on to keep it tight.

The feed supply should be regulated at the inlet valve to the economiser, and not at the boiler feed valve. If the regulation is effected by the boiler feed valve, there is always risk of obtaining a pressure in the economiser greatly in excess of that in the boiler, whereas by regulating the feed by means of the inlet valve to the economiser the pressure in the latter need never exceed the boiler pressure.

Special care should be taken to see that the economiser inlet and outlet valves are opened before starting the feed pump (or the injector), as in the event of either of these valves being closed when the pump is set working, either the latter will be pulled up or else the pipes will burst or the joints be broken. The object of a feed relief valve, which must not be confused with the safety valve, is to prevent the pipes from bursting or the joints being broken in this way, and it is always advisable to have one of these valves attached.

A maximum registering pressure gauge ought also to be provided, as any excessive pressure will be indicated by it. When undue pressure is registered the cause should always be investigated. It may be due to one of the valves having been closed when the pump is started, or to the fact that there is no air vessel on the delivery side of the pump.

Not only should each safety valve be tested by hand daily, but it is desirable to occasionally take it asunder and thoroughly overhaul it if found necessary.

It will be gathered from the foregoing remarks that fuel economisers are not only liable to become weakened and deteriorated, but that their working may be attended with a considerable amount of risk. The importance, therefore, of placing them in charge of competent and reliable men cannot be too strongly urged, and as a further precaution, it is always advisable to have them regularly examined and inspected by some independent expert, such as an inspector of one or other of the leading boiler insurance companies. Under such conditions, their working life would be largely increased, whilst at the same time accidents and explosions would be of very rare occurrence.

BUSINESS NOTES.

Consular Notes.—Bolivia.—In a recent report H.M Consul at Sucre reports that the electric lighting installation in that town was inaugurated at the end of the year 1908—exactly one year after the time stipulated in the municipal contract. Though the whole installation bears some evidence of having been carried out with the greatest possible curtailment of expenses, it may be justly said, when hitches cease to occur, that the town is well lighted. Altogether some £20,000 has been invested, calculated to yield about £4,000 annually in the immediate future, but as the monopoly is for 30 years some £20,000 more ought to be spent to make it efficient. For lighting private houses and establishments the standard price for electric light is 3 bols. 50 cents (5s. 7d.) per month per 16-c.p. lamp. Where a light is required to burn every night this is, light for light, cheaper than petroleum or candles. Where several lights are required in one house a considerable reduction is made, thus, for an establishment that has ordered 100 lights, the price is 2 bols. (3s. 2d.) per 16-c.p. lamp. For motive power there is a great opportunity. The electrical energy is derived from water-power at a generating station on the River Cachimayo, about 8 miles from Sucre. It is transmitted at a very high voltage to the edge of the town, where it is transformed and distributed over the whole network of low-pressure wires. The mains are uncovered wires running parallel to and along the streets on poles about 15 ft. high "and somewhat dangerously near to the balconies of the houses." The unforeseen circumstances which delayed the full equipment of the public service were considered by the municipal council as being sufficiently fortuitous to warrant their waiving the heavy penalty which should have been imposed on the contractors according to the terms of the contract. Some of these circumstances, as well as the numerous obstacles which still impair the regular supply of light, are worth mentioning as showing the nature of the difficulties which have to be carefully considered when undertaking public works in this country.

In the first place, the machinery, which could not be reduced to the requisite limit of weight (300 lb.) for carrying on mules, commenced to arrive at Huanahuaca in the wet season, when carts could not be run. When, eventually, the roads were repaired, the whole system of forwarding traffic had broken down at Huanahuaca, and no-one could cope with the ever-increasing quantity of goods brought up by the railway. The effort of the contractors to get their machinery through resulted in a better organisation all along the route from Rosario to Sucre. An indispensable part of the machinery was found to be missing; a new piece was cabled for, and meantime a substitute was manufactured at the works of the Huanchuaca Co., which was not altogether satisfactory. Some part of the dynamos also had got wet, and could not be made to work. The supply of wooden posts for carrying the overhead wires was not equal to the extraordinary demand, with the result that much delay was caused. More than 800 of these posts were required, of quina-quina wood or eucalyptus, 8 ft. long × 5 in. × 5 in., and they had to come from a long distance. It may be observed that these posts are unsightly and cannot last long, and that British manufacturers might consider if they could not produce cast-iron posts at less than 6s. 8d. per 8-ft. length, that would better suit the purpose. In the Department of Santa Cruz and the eastern provinces, however, wood is much cheaper, its value being about equal to the cost of cutting it. Other difficulties became apparent after the electric light was working, owing to some of the peculiarities of the rivers on the Bolivian uplands not being properly

appreciated. Their enormous erosive powers were underrated, for when the volume of water increases tenfold during the summer floods, the rivers completely fill the narrow ravines in which they are hemmed, destroying their own banks and the artificial barriers erected thereon. In the present case the inlet and sluices were solidly constructed, but being below the low water level, each successive flood obstructed them with tons of sand, boulders, and tree trunks and other *débris*. Until experience evolves some means of dealing with the caprices of the river, an auxiliary oil or steam engine must be used to keep up a continuous current, nominally during about 120 days, constituting the worst part of the rainy season, but practically less than half the time, which is all that would be found necessary. The fact is that light must be supplied during every night for 30 years, and the penalty for each night that it fails, besides the discredit, is £8. There is no reason why any firm erecting a factory in Sucre should be altogether dependent on the electric light company for its motive power. The monopoly of this concern extends only within the urban district, and many other generating stations can be erected on other parts of the same river to supply energy for works situated just outside the town.

Live Trolley Standards.—Referring to the liability of the trolley standard to become alive through some accidental cause, with consequent danger to passengers, the British Thomson-Houston Co., Ltd., of Rugby, have drawn our attention to a system which they have introduced to prevent accident from this cause. This arrangement ensures that immediately the trolley standard becomes alive, an audible signal will be given by the ringing of a special type of electric bell, and simultaneously by the lighting up

B.T.-H. Alarm Bell.

of two red lamps fixed above the car platforms. These signals are independent of each other, so that the failure of one cannot interfere with the proper working of the other. This system is entirely automatic in action, and does not require a battery or any mechanical gear for its operation, nor does it in any way interfere with the running of the car. The provision of two distinct, independent and automatic signals, one audible and the other visible, fully meets with the recommendation of the Board of Trade. An interesting feature of the system is the construction of the leakage indicator or bell, which is designed to work on 500 volts. This special type of bell, as may be seen from the illustration, is completely enclosed in a metal case and adapted for fixing under the canopy, where its warning can be instantly heard by the driver or conductor. The B.T.-H. leakage indicator has been in successful use for the last five years on the tramways at Scarborough and Leith, and also at Dunfermline.

Robertson Fire Brigade Successes.—As the result of the 11th Annual Tournament of the London Private Fire Brigades Association, which was concluded on the 27th ult. at the Headquarters of the London Rifle Brigade, Bunhill Row, E.C, the Robertson Electric Lamps, Ltd, Fire Brigade was successful in winning the "Nestlé" Challenge Cup, for the Championship of the United Kingdom (for the best aggregate times for wet drills by teams of three and five men); the "Marshall" Challenge Cup, for the championship of the London Private Fire Brigades Association (for the best aggregate times for dry drills for one and two men, wet drills by teams of four men, and scaling ladder and hand-pump drills by teams of five men each); the "Dewar" Challenge Shield—for four men wet drill. We understand that the winning times constituted a record in any drills of this class.

Places of Worship and Electric Lighting.—A correspondent says the trustees of a score of chapels in and around Bolton have put down on their business agendas for the next quarterly meeting, the question of adopting electric lighting.

Meter Approved.—The B. of T. has approved of meter No. 369,278 deposited by the Electrical Co, Ltd., on June 12th, 1908, and known as the Electrical Co.'s single-phase alternating-current watt-hour meter, type L.J.

Electrical Works in Russia.—A special dispatch from St. Petersburg to the *Financial News* reads as follows: "The use of electricity in Russia is still somewhat limited. There are only 30 cities possessing an electric tramway system, and of the 80 cities lighted by electricity, 40 have their own electrical works, the supplies in the remainder being provided by private enterprise. The following figures show that the electrical undertakings in Russian cities are very remunerative. The net profits of the works of the City of Vilna were 83,851 roubles, or 50 per cent.; Wolvgda, 18,078 roubles, or 39 per cent.; Minsk, 14,849 roubles, or 35 per cent.; Nicolaieff, 34,554 roubles, or 33 per cent.; Orenburg, 38,064 roubles, or 44 per cent.; Poltava, 28,642 roubles, or 49 per cent.

Trade with Sweden.—"Why not extend your trade connections with Sweden?" is the question which the Swedish Chamber of Commerce in London is asking British manufacturers and merchants. Comparatively few English firms send travellers to Sweden, whereas German travellers are there in abundance. The Swedish Chamber of Commerce, 5, Lloyd's Avenue, London, E.C., of which His Majesty the King of Sweden is a patron, have several departments which give facilities to firms wishing to establish Anglo-Swedish trade connections, and also a Credit Information Department, through which the interests of members are safeguarded. Lately a Special Intelligence Branch has been added to the Chamber, which circularises to the members particulars *re* trade openings and new markets, &c.

Catalogues and Lists. — Messrs. Cowans, Ltd., Springfield Lane, Salford, Manchester. — Illustrated card giving prices of their low-tension oil circuit-breakers and switches.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Illustrated leaflets containing descriptive particulars of a newly completed line of control apparatus for squirrel cage induction motors. They deal respectively with types "P" and "O P" auto-starters for motors of from 1½ to 200 h.p., 100 to 600 volts; main, reversing and direct starting switches for d.c. and two or three-phase motor circuits (up to 70 amperes on 1,000 volts); two, three and four-speed starters; star-delter and series-parallel starters for two and three-phase motors.

The British Prometheus Co., Ltd, Salop Street Works, Highgate, Birmingham.—New season's catalogue (34 pages) of electric heating apparatus. The Prometheus convector principle is first described, and a fine assortment of artistic designs of convectors and luminous radiators occupy the remainder of the book, some new Adams' designs being included. Among interesting novelties we observe an imitation log-fire in which convector elements are employed, and the imitation logs themselves are illuminated; also a circular four-lamp beaded radiator, the colouring of which we should think produces a very good effect. All the designs in the book are admirably printed, and prices are set forth.

The Stebling Telephone and Electric Co., Ltd., 200, Upper Thames Street, E.C.—We have received a novel showcard of large dimensions (38 in. × 26 in.), on which are mounted actual samples of the "Parlyphone," which has been completely remodelled. As shown in the accompanying illustration, the reception room instrument, finished in cream and nickel, and the kitchen set, finished in

A Novel Showcard.

black and nickel, are illustrated in their appropriate surroundings. The showcard is accompanied by a booklet, No. 157, giving particulars and prices of the apparatus, for ringing one way, as shown, or both ways, and various accessories, as well as diagrams of connections. This forms, we believe, an entirely new departure in showcards. We hope the example will be followed by the manufacturers of radiators, lamps, cooking apparatus and turbo-generators. The parlyphones, of course, speak for themselves; we have put one into use, and find it quite satisfactory.

The Crosthwaite Fire-Bar Syndicate, Ltd., York Street, Leeds.—Pamphlet containing illustrations of, and information

relating to, the Holehouse and Crosthwaite patent water-cooling plants, for electricity and other works. Large drawings appear of exhaust steam turbo-generating installations with patent barometric condenser, and with patent low-level jet condenser.

Messrs. Spagnoletti, Ltd., Goldhawk Works, Goldhawk Road, London, W.—Interesting wall calendar for 1910, on which a number of pictures in colour appear showing the excellent service that can be rendered in the different departments of the house by the "Therol" system of electric heating. The calendar does not contain the name of Spagnoletti, but refers the reader to "The Manager, Electric Supply Station," for full particulars.

The Tudor Accumulator Co., Ltd., 119, Victoria Street, London, S.W.—Sixteen-page pamphlet, in which is given an illustrated account of the T.A.C. system of electric train lighting.

Messrs. Archibald J. Wright, Ltd., Leyton Green Road, London, N.E.—Several new lists, which are of seasonal interest just now in view of the present-giving occupation which we shall all find so pleasurable before many weeks are past. A large variety of electrical goods and scientific and mechanical novelties are covered in a 32-page catalogue; pocket, flash and other lamps and a number of small electric toys are set forth in a leaflet; further circulars give prices of armature stampings, the "monowatt" metallic-filament lamp, and a list of trade discounts.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—Advance copy of list No. 91 (of a size suitable for the overcoat breast pocket), wherein are given in the course of 64 pages of very neatly arranged and well illustrated matter, full particulars, pictures and prices of the company's manufactures—motors, dynamos, arc lamps, switchgear, meters and other electrical apparatus for all industrial purposes.

The Bryant Trading Syndicate Ltd., Horsell Road, Highbury, London, N.—Four-fold leaflet relating to the claims of the British "Metalite" incandescent electric lamp. Four interesting pictures are intended to illustrate the four stages in the advance of lighting—200 years ago, the candle; 150 years ago, the oil lamp; 100 years ago, gas lighting; 1908, "Metalite" lamps. We will not vouch for the accuracy of those dates, but the pictures well serve the object of the firm.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Illustrated leaflet relating to the "Economic" electric stove suitable for 100 to 250 volts and for A.C. or D.C. circuits. It also shows a combined polished aluminium radiator and stove.

The Electrical Co., Ltd., 121—5, Charing Cross Road, W.C.—Two illustrated lists in their usual form, one showing and giving prices of motor starters for continuous-current motors; the other particularising a number of accessories such as lampholders, tumbler switches, adapters, and so on.

Mr. George Ellison, Warstone Lane, Birmingham.—Price leaflet of mill type ironclad switches and fuses.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—20-page catalogue (No 301) just issued for the 1909-10 season, containing particulars of the various types and sizes of "Efesca" metal-filament lamps that they have in stock. Comparative information is given as to the running cost of "Efesca" and carbon lamps, for the use of contractors and dealers in educating consumers up to the current-saving qualities of the lamps. Particulars appear of the reduced prices for "Efesca" auto-transformers. Members of the trade can have copies of the list on application.

Mr. G. Wuthrich, Norfolk Street, Strand, W.C.—12-page illustrated descriptive list relating to the Oerlikon portable, electrically-driven hand-drilling machine for D.C., single, two and three-phase A.C. Prices and data are tabulated.

The Brush Electrical Engineering Co., Ltd., 106-112, Belvedere Road, London, S.E.—8-page price list of Brush "Metallum" (Colloid-Tungsten) lamps. Illustrations appear of both pear and round shaped bulbs, and of a number of adapters for series lamps, cluster and shop window fittings and shades.

Trade Announcements.—Messrs. Tetley & Co., of Salford, have been appointed sole agents for Lancashire and Yorkshire by the Electrical Apparatus Co., Ltd., Milford Works, Queen's Road, Battersea, London, for the sale of their motor starting and control gear.

The business of The Bell Telephone and Electric Co., of Great Smith Street, S.W., has been acquired by Messrs. Frederick Hodgson & Co., of 24, Queen Victoria Street, E.C., and will in future be carried on under that name.

The Cowper-Coles Engineering Co., Ltd., now have their new works at Willesden in full working order, where they are making some of their specialities such as pumps, injectors, and valves, for the circulation of corrosive liquors, a new form of sand blasting machine for the removal of scale and oxide from iron and steel, machines for welding aluminium, centrifugal filters and atomisers.

Bankruptcy Proceedings.—Harry Graham, electrician, &c., Albion Street, Huddersfield.—In this case the first meeting of the creditors was held last week at Huddersfield, when it was decided that Mr. E. Netherwood, chartered accountant, and Mr. G. W. Smith, chartered accountant, should be joint trustees, a Committee of Inspection being also appointed. The liabilities were stated at £1,252, and the assets were estimated to realise £895. The failure was ascribed to losses on contracts, and to creditors pressing.

Samuel Emerson Smith, electrical engineer, 271, High Street, Lincoln.—The adjourned public examination of this debtor was held last week at the Sessions House, Lincoln, before Mr. Registrar Stephen. The liabilities were put at £125, and the assets were expected by debtor to realise £220. Replying to further questions by the Official Receiver, debtor stated that in 1904 or 1905, A. C. Smith & Co. executed an assignment; he had said to the best of his knowledge that the liabilities were about £400, and he would be surprised to hear that they amounted to over £720; he would not say they did not amount to so much, because he did not know. The Official Receiver said that in his last examination, debtor said that an offer was made to the trustee to sell as a going concern, and that it would pay about 15s. in the £ to the creditors, but debtor now said that he did not know the dividend was only between 1s. and 2s. in the £. Debtor was then examined with regard to Smith's Electrical Co., and eventually the Official Receiver asked that debtor be ordered to supply a cash account of his receipts and payments for the three months preceding the date of the receiving order. The case was again adjourned, debtor being requested to furnish the required particulars.

Dissolutions and Liquidations. — Bradford Electrical Engineering Co., Ltd., 56, Manningham Lane, Bradford. — A meeting of the shareholders was held on Monday afternoon at the offices of Mr. J. Herbert Haley, Incorporated Accountant, at 29, Tyrrel Street, Bradford, when a statement was presented showing the condition of the company's business. After some discussion it was resolved that the company could not, by reason of its liabilities, continue its business, and that the company should be wound up voluntarily under the provisions of the Companies' Consolidation Act, 1908, and Mr. J. Herbert Haley and Mr. George Edgar Corfield, incorporated accountant, of Balfour Street, Finsbury Pavement, London, should be appointed liquidators for the purposes of such winding up. The statement is not yet complete in details, but the liabilities are stated to be about £1,200, and the assets are described as substantial.

Adams-Randall Telephone Patents Co., Ltd.—At a meeting held at Dashwood House, E.C., on November 23rd, it was resolved to wind up voluntarily, with Mr. W. H. Parker as liquidator. A meeting of creditors will be held on December 8th.

W. A. Meadows & Co., electrical engineers, Hanley and Longton.—Messrs. W. A. Meadows and J. Cartlidge have dissolved partnership. Mr. Meadows will attend to debts and continue the business.

Messrs. Walker & Vickery, electrical engineers, 16, Widemarsh Street, Hereford.—Messrs. R. E. Walker and C. J. Vickery have dissolved partnership. Mr. Vickery attends to debts.

Headland's Patent Electric Storage Battery Co., Ltd.—A meeting is to be held at Finsbury House, Blomfield Street, E.C., on January 4th, to hear an account of the winding up from the liquidator, Mr. G. Dundas Price.

We learn that Mr. E. Skinner is retiring from the firm of Berry, Skinner & Co. The business will be carried on under the same name by Mr. Herbert Berry.

Charge of Stealing.—Before the Lord Mayor of London on Tuesday, A. J. Page and F. A. Clerk, both described as electricians, of Edmonton, were sentenced to three months' hard labour for being concerned in stealing and receiving from Queen Victoria Street, E.C., Osram lamps valued at £17 15s. 7d., the property of the General Electric Co., Ltd.

Stolen Cable.—William Beckett and Alfred Clark, two respectably-dressed men, were charged at the Hull Police Court with stealing about 1 cwt. of electric lighting cable belonging to the Hull Corporation. Both prisoners were fined £5 and costs, or in default 30 days' imprisonment.

Book Notices.—*Technical Dictionary in Six Languages.* Vol. 5. Railway Construction and Operation. By A. Schlomann. London: Archibald Constable & Co., Ltd. 1909. Price 12s. net.—The appearance of the fifth volume of the Deinhardt-Schlomann series will be welcomed by all who have experienced the advantages of using its predecessors. We have previously spoken so often and so highly of this invaluable series that it should suffice for us to draw attention to this new volume, without further explanation than to say that it is a verbal and pictorial dictionary of technical terms, limited strictly to the subject defined in the title. Rolling stock is treated of in a separate volume, and electric power plant has been dealt with in Vol. 2. There is a section on electric railway installations and another on signalling. We commend the work to our readers as the very best of its kind.

The Motor Manual. London: The Temple Press, Ltd. Price 1s. 6d. net.—The fact that "The Motor Manual" has reached a twelfth edition is sufficient testimony to the fact that it meets the proverbial long-felt want. The aim has been to produce a handbook that shall give the veriest novice in motor matters an insight into the many details comprised in a modern motor-car. The subjects dealt with cover the whole field of motoring, such matters as car construction, carburation, ignition by means of both accumulators and magnetos, clutches, change-speed gears, road wheels, tires, &c., all receiving attention within the 272 pages which the book contains. The text is well illustrated by clear drawings and sketches, the additions in this direction being one of the *raisons d'être* of the new edition. The work is, however, not confined to technical matters, for any motorist contemplating a tour either at home or abroad in his car will find a good deal of useful information within its pages. Other sections which have been expanded to meet new conditions are found in the chapters dealing with ignition magnetos and the electric lighting of motor vehicles. From the point of view of imparting a good deal of valuable information to non-technical motorists, there is no question that the manual should continue to meet with a large sale, for it is not only written in language that can be readily understood, but its price is within the reach of almost everyone. If we have any suggestion to make, it is that an alphabetical index might usefully

be incorporated in the next edition; while the beginner in motoring will probably read the book chapter by chapter, he will, when he meets with difficulties during the course of his motoring career, want to turn quickly to the page dealing with the particular trouble that he thinks his engine or car is suffering from, a task which would be facilitated by the index that we suggest.

"Electricity." By H. M. Hobart. London: A. Constable and Co., Ltd. 1909. Price 6s. net.

"Fortschritte der Elektrotechnik," 1908. Parts 3 and 4. Berlin: Julius Springer. 1909. Part 3, Price 10 M.; Part 4, Price 15 M.

Revision of South African Railway Rates.—We learn from the Natal Government Agency that as from January 1st next the preference on railway rates from Delagoa Bay to railway stations in the Transvaal between Germiston and Klerksdorp inclusive will be reduced in favour of Durban as follows:—

	s.	d.	
Intermediate class by	2	11	per ton.
Intermediate "B" class by	1	8	"
In rough, rough "B" and "C" classes	2	1	"
Imported produce, fencing, fertiliser classes ..	0	10	"

This is in addition to the reduction effected on July 1st last, which was as follows:—

	s.	d.	
Intermediate classes by	2	11	per ton.
Intermediate "B" classes by	2	11	"
Rough goods "B" and "C" by	2	1	"
Fencing, fertilisers, imported produce by.. ..	0	10	"

The intention of the further reductions is to divert a portion of the trade at present travelling by Delagoa Bay, it having been found that the reduction made on July 1st last was insufficient to accomplish that object. Attention is directed to the advantage of consigning goods *vid* the Port of Durban, as the effect of the further revision in rates is that the difference in favour of Delagoa Bay will be only 4s. to 5s. per ton, after allowing for the additional shipping freight and expenses at the latter port, which difference is outweighed by the superior facilities for wharfage, handling, trucking and transportation of consignments of all descriptions at the Port of Durban. Full information will be supplied on application to the Commercial Agent, Natal Government Agency, 26, Victoria Street, S.W.

Arc Lamp Lowering Gear.—THE LONDON ELECTRIC FIRM, of Croydon, have recently booked a number of contracts for their "Patent One Working Part" arc lamp lowering gear. These include:—

87 for the St. Marylebone Borough Council, consisting of single and double swan necks, and centre carrier gears, for Oxford Street and Upper Regent Street.

72 for Ealing Corporation, consisting of swan necks and centre carriers on traction pillars, and on lamp pillars with tank transformer bases.

80 for the Swansea Corporation, comprising swan necks, trolley arms, and span wire gears.

The centre-pole gears are "Converted Lyres."

S.M. Electromagnetic Clutch.—The Sosnowicer Iron Works have had a 1,200-H.P. clutch on a three-high rolling mill running at 350 R.P.M. for 10 months, and have just given a repeat order to MESSRS. C. E. LUGARD & Co. for a clutch of 1,400 H.P. at 200 R.P.M. to be fitted to another of their mills.

Cape Colony.—MESSRS. GEORGE FINDLAY & Co., of Cape Town, have recently opened a branch establishment at Oudtshoorn, for the supply of electrical and mechanical engineers' requirements. This is in anticipation of the electric light supply which is expected to be shortly inaugurated.

Christmas Boxes.—We have received from the Town Clerk of Keighley a copy of a resolution which was passed by the Town Council in August last, as follows:—"That all officers and employés of the Corporation be strictly forbidden to accept any gift of any description from tradesmen or others supplying goods or selling property to, or doing work for, the Corporation. Any person who is found to have violated this rule shall, *ipso facto*, forthwith cease to hold his appointment. That a copy of this resolution be sent to all persons and firms who now or may hereafter have an account with the Corporation in respect of the above matters." The Town Clerk notifies that any tradesman or other person as aforesaid offending against the above rule will be liable to be debarred from entering into any future contract with the Corporation.

Installation Contracts.—Among the installation contracts which are occupying the attention of MESSRS. TREDEGAR AND Co., of Westminster, are the following:—Austin Friars, large block of offices; St. James's Street, large block of flats; Spurr Street, ditto; St. James's Street, new premises for Messrs. Rumpelmayer; Marina Hotel, Barton; Charterhouse Square, new premises for Messrs. J. J. Smith; Norwood car-sheds, London County Council; and installations including plant at the following:—Alexandra Hospital, Clandon; High Clandon, Guildford; Hollybank, Wootton; Blatchingdon House, Seaford; Crelash, Heathfield; Halebourne, Chobham; Ewell Grove, Ewell, &c.

Carbide Agreement.—According to *Affärsvärlden*, an international syndicate has at last been formed to regulate the production and sale of calcium carbide, with offices in London and Nuremberg. The French and Italian works are not included in the syndicate, but arrangements have been made with the French firms for the purpose of preventing competition.

Burnley.—The electrical work in connection with the New Palace Theatre and Hippodrome, erected in Leeds Road, Nelson, has been carried out by MESSRS. J. BATTY & Co., of Burnley, and the ELECTRICAL NAME AND NUMERICAL SIGN Co., London, has fixed the electrical signs.

LIGHTING and POWER NOTES.

Aberdare.—The L.G.B. has sanctioned the borrowing of £17,000 by the U.D.C. for the provision of an electricity supply and a refuse destructor.

Ashton-in-Makerfield.—The Park Lane Co-operative Society has asked the U.D.C. for permission to take a supply of electricity from the South Lancs. Tramway Co., and, in the event of refusal, that it be given a supply by the Council. The matter has been referred to a Committee.

Aston Manor.—The mains are to be extended at a cost of £825, so as to supply the Villa Street and Nursery Road districts.

Australia.—The Sydney (N.S.W.) Council is experimenting with incandescent and arc lamps, with a view to determining the relative cost for street lighting purposes.

A publicity branch has been formed in connection with the electric supply department.

Barking.—A L.G.B. inquiry was held on November 24th into the application of the U.D.C. for a loan of £2,500 for electricity purposes. The sum was made up as follows: Excess expenditure, £745; new plant, £750; transformers, £250; mains extensions, £250; house services, £200; public lighting extensions, £200; meters, £105. There was slight opposition with regard to the sum applied for on account of excess expenditure.

Bexhill.—The Council has ordered 300 Osram lamps for street illumination. The working of the new cooling tower and the old condenser has resulted in the cost of production being reduced to 44d. per unit, or exactly half what it was two years ago when Welsh fuel only was used. It is anticipated that still better results will be obtained when the new condenser is at work.

Blackburn.—A "shopping festival," which concluded on Saturday evening, and for which the Corporation offered special terms for the consumption of electricity, resulted in no fewer than 6,300 equivalent 8-C.P. lamps being specially fixed for the week.

Bridlington.—The T.C. has received from the L.G.B. sanction to a loan of £5,057 for extensions at the electricity works.

Brighton.—The Lighting Committee has recommended the Council to approve of a wiring scheme, under which a firm of contractors will provide all the wiring and fixtures free of expense, risk or responsibility to the Council, consumers to be charged 1d. per unit above the ordinary lighting rate. The extra 1d. under the scheme is to go to the contractors for the purchase of the installation by the owner of the premises wired. When the consumption reaches 240 units per point installed, the fixtures will become the property of the owner.

Burnley.—Owing to the abnormal demand for electricity meters, the loan of £500 sanctioned by the L.G.B. in 1908 to cover expenditure on meters for the next three years, has already been overspent. The Electricity Committee, instead of applying further to the Board, has instructed the engineer to debit the cost of meters to revenue account until further notice.

Caerphilly.—The U.D.C. has recently transferred its powers under a prov. order to light the district electrically to a local company which is, under the agreement with Council, authorised to light the whole of the district, with the exception of the Town Ward. The company is proceeding to connect the Aber Ward—comprising the mining villages of Abertridwr and Senghenydd, with a population of over 20,000—with its system.

Callan.—The lighting of the workhouse by electricity occupied the attention of the Guardians at the last meeting, and a Committee has under consideration a scheme formulated by Mr. Lamb, of the Munster Electrical Co., who has a scheme in hand for the electric lighting of the town.

Canada.—Owing to an accident at the power house of the Winnipeg Electrical Co., the electric supply in the city has been cut off, and many factories and elevators have had to cease work. The tramways are giving a restricted service.

France.—The Parisian public must be somewhat tired of the joking propensities of M. Pataud, secretary of the Electricians' Union.

It is reported that on the occasion of the visit of the King of Portugal to the Opera on November 30th, 15 minutes before the commencement of the performance, the stage electricians received notice to strike unless their pay was increased to the same level as the stage hands.

Under the circumstances the managers of the Opera wisely agreed to sign a "contract," but as the men are employés of the Edison Co., and not of the Opera, it will be evident that the so-called contract is void.

Dublin.—The L.G.B. has sanctioned several amounts of of the loan of £253,428 asked for by the Corporation for various improvements in the Irish capital and suburbs. These amounts include £75,000 for electrical extension—that is, £34,210 for new works and £40,790 for work already completed.

Fife.—The first of the four 300-H.P. suction gas engines at the Rosyth naval base has been set in motion, and portions of the outworks are now lighted by electricity. When the power station and the engines are completed, comparatively little steam power will be used.

Haslingden.—At the Council meeting on November 25th, it was stated that the provisional order for the supply of electricity by the Corporation expires at the end of next February, and that as it has several times been renewed the B. of T. now intimates that it will not renew it beyond the date of expiry, unless it is shown that it is being utilised. In these circumstances the Corporation is making inquiries with a view to ascertaining if a reasonable number of people will take current for lighting or power.

London.—Marylebone.—In order to push the sale of apparatus having 100 per cent. load factor, the Council has approved of a tariff of 1d. per unit on same. The general manager of the electricity undertaking has been authorised by his Committee to expend £60 during the ensuing year upon literature produced by the Associated Municipal Electrical Engineers (Greater London) through their Publicity Committee. It is explained that this is not a subsidy, as the literature would be produced by the department in any case, but at a greater cost and at much greater trouble. The General Purposes Committee has agreed to have new fittings and additional wiring at the Town Hall; also electric radiators in the positions where gas stoves are now. Last year's account for electricity and gas amounted to £157, of which £30 was for gas. The cost under the new scheme will be £167, of which £24 will be for electric heating. For the small additional cost, the candle-power of the lighting will be increased nearly 2½ times. The cost of the installation is estimated at £137.

Hornsey.—The Council has decided that the rates for energy to be charged for motors used for the purpose of driving gas compressers be in each quarter 13s. 4d. up to 20 units, and for each unit over 20 units, 6d. In the case of Therol heaters the charge for a 200-watt heater is to be 7 guineas per annum, and *pro rata* for other sizes, provided the current is used for the purpose of the heaters only.

Hampstead.—With a view to encouraging the use of electricity for heating and power purposes in private houses, the Lighting Committee has been authorised to enter into agreements with occupiers on a basis of £8 5s. per KW. per annum (payable in advance) for the maximum demand required for lighting houses throughout with electric light, together with 1d. per unit for all current supply, for whatever purpose it may be required.

Mansfield.—The T.C. has decided to give an abatement of 10 per cent. to consumers of electricity through slot meters. The mains are to be extended at a cost of £250, in order to supply energy to the new rescue station in York Street, Mansfield Woodhouse.

Merthyr Tydfil.—In spite of the refusal of the L.G.B. to assent to the proposal of the B.G. to substitute electricity for gas for lighting the workhouse, the Guardians have decided to have included in all future specifications for new buildings the wiring of the same for electric lighting.

Middlesbrough.—The T.C. is seeking powers to deal in and to let out on hire electrical fittings and apparatus.

St. Austell.—The U.D.C. has accepted the tender of the Electricity Co. for public lighting for three years. The tender was £179 4s. 6d. per annum against £269 for gas.

Sheffield.—The T.C. has decided to apply for a prov. order for electric lighting for the parish of Tinsley.

Spalding.—The B. of T. has revoked the 1905 prov. order.

Tipperary.—The Board of Guardians has had under consideration the lighting of the workhouse by electricity, Mr. L. J. Lawless, M.I.E.E., Dublin, having been engaged to prepare a scheme.

Trowbridge.—The B. of T. has revoked the Trowbridge Urban, Bradford-on-Avon Urban and Rural order of 1904.

Widnes.—The T.C. is seeking a prov. order to alter and amend the orders of 1901 and 1904. A new compulsory area of supply is scheduled, and power is sought to supply in bulk both inside and outside the borough, and to lease the powers to the Salt Union, Ltd., or any other company.

Wimbledon.—A charge of 2d. per unit is to be made for energy supplied to tradesmen for the purposes of Christmas decorations, provided their premises are wholly lighted by electricity supplied by the B.C.

Wolverhampton.—A L.G.B. inquiry was held on Friday, last week, into an application by the Corporation for sanction to borrow £10,000 for the purposes of the electricity undertaking. Mr. C. E. C. Shawfield, the Corporation's electrical engineer, remarked that advantage was being taken of electricity as a motive power, and added that the profit per unit on the output was one-tenth of a penny. The Inspector observed that this was a small profit, and did not admit of a reduction in price without putting the Corporation on the wrong side. Mr. Shawfield replied that if undertaking was run by a company, they would, after setting aside a sufficient sum for depreciation, be able to pay a dividend of 6 per cent.; and very few electric lighting companies in the country were so sound as the Wolverhampton Corporation's undertaking. At the Inspector's suggestion, it was decided to increase the loan applied for to £15,000, and the town clerk said the necessary resolutions to this effect should come before the Council meeting in December. Details of the proposed expenditure were given, after which the inquiry closed.

TRAMWAY and RAILWAY NOTES.

Australia.—The report on the working of the N.S.W. Government Railways and Tramways for the quarter ended September 30th last, shows that 155 miles of tramways are open, 5,157,600 car-miles were run and 46,745,626 passengers were carried. The revenue amounted to 1s. 0¾d., and the expenses to 10¾d. per car-mile.

Blackpool-Fleetwood.—The appeal of the Blackpool and Fleetwood Tramroad Co. against the Fleetwood U.D.C. and Improvement Commissioners as to the rating of the company's track as a tramway instead of a railway, has been dismissed at the Preston Sessions. The Court consented to state a case.

B.E.T. Tramways.—An innovation in the form of a new system of fare collecting is to be introduced on the tramway systems controlled by the British Electrical Federation, in the New Year. The idea is to replace the present method of overlapping stages by a system under which the route is divided up into equal ½d. sections, which will be indicated to the passenger by painting black or white bands round the poles and numbering them according to the section. The tickets will be printed with alternate dark and light sections numbered to correspond with the route sections, and in different colours to distinguish the denominations. The minimum fare is to remain 1d., and on many routes the long-distance fares will be on the basis of more than four sections for 1d. In order to get over the difficulty introduced by the use of the ½d., it is proposed to issue books of ½d. tickets.

Burnley.—The covered-top cars have proved so successful that the Corporation is to have others converted. The covered cars are almost a ton heavier, but the new truck provided for them has been responsible for a reduction in the energy consumed by the cars.

In proceeding from Rosegrove to Burnley, an electric tramcar on November 25th failed to take the points properly. The front bogie took the wrong points but the back one took the right ones, with the result that the car swung practically across the street. The rear portion of the car struck a brewer's dray, and both tramcar and lorry were damaged.

Continental Notes.—Switzerland.—Plans are being prepared in respect of a projected electric tramway between Basle, St. Jacob, Liestal and Sissach.

Germany.—An electrical motor-hearse has recently been put in service at Stahnsdorf, near Berlin.

Dublin.—A deputation recently waited on the directors of the Dublin United Tramways Co., with a view to inducing the company to extend its system into Blanchardstown, Castleknock and Cabra.

Edinburgh.—The Corporation Tramway Committee has sent to a sub-committee for consideration two schemes for electric tramways to Queensferry. The latest proposal was submitted from a company, for which Messrs. Deas & Co. are agents. The route is from Queensferry Street *via* Belford Bridge.

Ilford.—At the last meeting of the District Council the Tramways Committee recommended that the new tramway manager's commencing salary be £300 per annum, rising by annual increments of £25 to £400. Councillor Sheat said that they proposed to appoint an electrical engineer with workshop training. He would have to be a good manager and organiser. Councillor Stroud said that at present they had no expert engineer to answer questions at, say, a Board of Trade inquiry after a bad accident. The recommendation was carried.

Liverpool.—Authority has been granted by the Electricity and Tramways Committee for the building of an experimental tramcar capable of providing 20 per cent. more inside accommodation than is available in the present class of car. The new car is to be built at the Corporation's Lambeth Road works, and it is hoped thereby to mitigate the inconvenience of "strap holders."

London.—Parliamentary notice has been given of a Bill for the construction of an electric railway linking up the District terminus at Wimbledon with Sutton, and passing through Merton, Morden, Carshalton and Cheam. The Sutton terminus will be in

the Brighton Co.'s station, with a view to providing for interchange of traffic. The Brighton Co.'s train connection between Sutton and Wimbledon is notoriously bad, slow trains requiring 72 minutes for the 5-mile journey.

L.C.C.—The proposals in regard to through-running between Aldgate and the East and West Ham and Leyton Councils' systems, which were referred to in our last issue, have been adopted by the L.C.C.

Newcastle-on-Tyne.—At a meeting of the Tramways Committee on November 25th a letter was read from the B. of T. suggesting that a conciliation board should be formed on lines similar to those adopted by the L.C.C. for the purpose of dealing with the grievances of the employés. The Committee did not adopt the suggestion, as it considered that the men's grievances were not of so serious a nature as to necessitate the formation of such a board. A large number of the men have decided to withdraw their labour if their complaints are not remedied, but the actual decision to strike is held in abeyance.

Portsmouth-Hayling.—The Light Railway Co. has applied to the Light Railway Commissioners for an order to revive and extend the period limited by the order of 1905.

TELEGRAPH and TELEPHONE NOTES.

American Combine.—It is rumoured that the amount of shares acquired by the American Telegraph and Telephone Co. in the business of the Western Union Telegraph Co., was 4 to 5 millions sterling, out of the 20 millions stock of the latter, probably with voting rights on an additional amount.

Cable Repairs.—Jamaica-Porto Rico, repaired November 25th; Paramaribo-Cayenne and Cayenne-Salinas, repaired November 29th.

Canadian Telegraph Rates.—The Board of Railway Commissioners has peremptorily forbidden the Canadian telegraph companies to put in force the new rule respecting code words, mentioned in our last issue.

Extension of Patent.—Notice is given in the *London Gazette* that Mr. Marconi intends to apply for the extension of Letters Patent No. 12,039, of 1896, on January 15th, 1910; notices of opposition to the application must be lodged in the Chancery Division of the High Court of Justice on or before January 14th, 1910.

Nottingham.—In view of a proposed transfer of the headquarters of the North Midland District engineering staff to other centres, a deputation recently waited on the Postmaster-General, who, it was understood, decided to remove the clerical staff only, leaving the whole of the electrical engineering staff and workshops at Nottingham. It turns out, however, that this was a mistake, and only the sectional staff will remain.

South Africa.—The Natal Government is placing an order with the Marconi Co. for the establishment of a station at Durban, with a range of 350 miles. It is proposed that stations should be erected on the Cape coast at Saldanha Bay, Cape Agulhas and Port Elizabeth. Steamers equipped with the system will be in communication with land two days before they reach Cape Town or Durban.

Turkey.—Reuter announces that the Commission charged with the examination of the tenders for the establishment of a telephone system in Constantinople has pronounced in favour of the Anglo-Franco-American group, composed of gentlemen connected with the National Telephone Co., Ltd., and the British Insulated and Helsby Cables, Ltd., both of London; the Western Electric Co., of Chicago; and the French Thomson-Houston Co. The choice of the Commissioners is subject to the approval of the Minister of Finance, but that is considered to be certain.

Wireless Telegraphy. — According to an American Consular report, the Russian Government has decided to send an official of the Telegraph Department to the United States, for the purpose of making arrangements with some American wireless company so that communication may be established between the United States and the wireless station to be built at Kamchatka.

It is reported that the Marconi Co., in return for a licence to erect a station at Johannesburg, offers to compete with the cable companies by accepting messages at 1s. a word, instead of the present 2s. 6d. rate. A 20-years' licence is asked for, and the Marconi directors are prepared to insert a clause in the contract to the effect that the station shall become Government property at the end of that period.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—Year's supply of colliery stores, for Powell Duffryn Colliery Co. F. Hanford, secretary, 101, Leadenhall Street, London, E.C.

Aberdeen.—The Corporation Electricity Department invites tenders for the supply of ironmongery, brass, lead and tin work, wrought-iron tubes and fittings and other stores. J. A. Bell, electrical engineer, Millburn Street.

Australia.—Melbourne.—December 6th. 230 A.C. and 160 D.C. electricity meters for the Council. See "Official Notices" November 19th.

Melbourne.—December 8th. 4,508 yards of single-conductor lead-covered cable, and 1,500 yards three-core lead-covered cable. See "Official Notices" November 26th.

Melbourne.—December 13th. 50,750 incandescent lamps for the City Council. See "Official Notices" November 26th.

Melbourne.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

March 16th, 1910.—A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Perth.—December 14th. Battery material, telegraph instruments, telephone switchboards, lead-covered cable, and measuring instruments for the P.M.G., Perth. Apply Commonwealth Offices, 72, Victoria Street, S.W. Time is short.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

January 31st.—The municipal authorities of Waremme are inviting projects for the establishment of a central electric station in the town.

Cape Town.—January 5th. The Corporation require tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Durham.—December 13th. Stores, including electric fittings, for the Trimdon Grange Colliery Co. (Walter Scott, Ltd.), Durham.

Eccles.—E.L. fittings for Beech Street Schools, for the Borough Education Committee.

Edinburgh.—December 6th. Electric lighting installation at the refreshment rooms, blood-treating house, &c., in connection with the Corporation's new slaughterhouses at Gorgie. F. A. Newington, electrical engineer. Deposit £1 1s.

Govan.—December 13th. Turbo-alternator, rotary converters, and high-tension switchboard for the Electricity Committee. See "Official Notices" to-day.

India.—Lucknow.—December 31st. The Municipal Board invites proposals for the supply of electrical energy, coal or oil gas. See this column for October 29th, and an article in our issue of November 19th.

London.—Stepney.—The Council is about to invite tenders for a complete system of coal and ash handling plant, consisting of riverside electric crane and grab, weighing hopper, gravity bucket or telpher type of conveyor, and auxiliary plant. Pending the carrying out of this work, an electric hoist, at £62, is to be obtained from Lambie, Wrigley & Co., for the removal of ashes from the basement at Blyth's Wharf.

Southwark.—38-instrument central-battery telephone installation at East Dulwich Grove Infirmary for the Guardians. See "Official Notices" to-day.

L.C.C.—December 14th and 15th. Overhead electrical equipment for the construction on the four-wire system of electric traction from Woolwich to Eltham. Electric light and bell wiring and fitting for the Poplar Divisonal offices for the L.C.C. See "Official Notices" to-day.

Llwynypia.—December 10th. Electrical accessories and fittings for six months, for the Cambrian Collieries, Ltd., Glamorgan Coal Co., Ltd., and the Naval Colliery Co, Ltd.; General Offices, Llwynypia, Pontypridd.

Manchester.—December 13th. Wiring and complete E.L. installation (about 700 lights), at Harpurhey Baths; City Architect, Town Hall, Manchester, (Returnable deposit, £2 2s.)

Middleton.—December 7th. Coal for the Corporation electricity works; Mr. S. Pauls, electrical engineer.

Poplar.—December 8th. Electric fan and fittings for the Workhouse Laundry. See "Official Notices" November 26th.

Prussia.—December 7th. The Prussian State Railway authorities at Dortmund are inviting tenders for the supply of two electrically-operated coal-loading cranes.

Roumania.—December 10th. The municipal authorities of Bucharest are inviting tenders for the establishment of a central power station for the supply of the current required for the electric tramways and for electric lighting purposes on the outskirts of Bucharest, as also for the establishment of a sub-station in the centre of the town.

Russia.—March 14th, 1910. The municipal authorities of Samarkand are inviting tenders for the concession for the construction and working of eight kilometres of electric tramways in the town.

Spain.—December 10th. The municipal authorities of Tabernas (Province of Almeria) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

The Direccion de Telegrafos has been authorised to acquire 400 kilogrammes of covered wire, 20 metres of type B cable, and 4,000 metres of aerial telephone cable, with 28 conductors.

December 15th.—Urban telephone system of Gijon for 15 years. Deposit £110. Local representation. Fuller information in *Board of Trade Journal*.

CLOSED.

Algeria.—The Post and Telegraph authorities in Algiers have just given out contracts as follows:—

La Société des Trefileries et Laminoirs du Havre.—10 tons of galvanised iron wire 3 mm. dia., at 810 fr. per ton, and 150 tons ditto 4 mm. dia., at 800 fr. per ton.

La Compagnie d'Electricité, of Paris.—Fifty tons of copper wire 2½ mm. dia., 30 tons ditto 3 mm. dia., 55 tons ditto 3½ mm. dia., and 80 tons ditto 4 mm. dia., at 2,150 fr. per ton.

Bolton.—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the purchase of scrap copper, and that of Messrs. W. Hamer & Co. for the purchase of scrap brass, scrap lead and burnt iron.

Burnley.—The E.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the supply of 450 yards of ·25 sq. in. cable and 900 yards of ·5 sq. in. cable for £454.

Canada.—Toronto.—Another example of what British firms are doing in Canada, is the placing of the order by the city of Toronto, for four pumps each to deliver 13,500,000 gals., and four each to deliver 16,000,000 gals. in 24 hours, with Jens Orten Böving and Co., of London, E.C. The pumps will be somewhat similar in design to the two pumps each to deliver 100,000 gals. per minute, which this firm are supplying to the Alexandra Docks, Newport, (Mon.). In the design of these large units, Messrs. Böving & Co. derive useful information and practice from their work in connection with water turbines. It will be remembered that another of their recent orders for Canada was for five turbines each of 5,300 H.P., and two of 450 H.P. for the city of Winnipeg.

Contracts for a new power plant were given out at Bracebridge, Ont., a few days ago. The construction of the general works of the hydro-electric development of Wilson's Falls, Muskaka River, consisting of dams, coffer dams, rock excavation, concrete walls, foundations, &c., was awarded to Canadian Contracts Co., Ltd., Toronto, for $19,341; hydraulic machinery, including 1,100-H.P. turbine, 35-H.P. turbine, governor penstock, to Wm. Kennedy and Sons, Owen Sound, Ont., at $3,100; for the electrical machinery, including generator, exciter, switchboard, &c., the Canadian General Electric Co., Toronto, $3,724. There were a large number of tenderers in each of the three classes. At Ottawa the contract for the 10-circuit repeater switchboard and storage battery was awarded to the Northern Electric Co., of Montreal, for $8,497.

Dundee.—Messrs. Thermit, Ltd., have received an order for one of their complete rail grinding outfits for the Corporation Tramways.

East London (South Africa).—Messrs. Thermit, Ltd., have received an order for the necessary material and appliances for the welding of 500 joints in connection with the extension of the tramways, also for one of their rail grinders (Mattinson's patent).

Falkirk.—The offer of Mr. Cuthberton, Falkirk (£136), has been accepted for the electric light installation in the Falkirk High School extensions.

Hull.—The tender of Messrs. A. Bannister & Co. for the supply of coal was accepted by the E.L. Committee, at 8s. 3d. per ton. This, it was pointed out, was an increase of 2d. a ton on last year's price. Mr. Lofthouse remarked that it would make a difference of about £300 a year to the committee. The engineer commented that the price of slacks would continue to go up until people went back to hard coal. A considerable quantity of slacks was being exported for manufacturing purposes.

London.—Admiralty.—The Electrical Apparatus Co., Ltd., has secured the Admiralty contract for Admiralty pattern No. 624 enclosed fuses, up to December, 1911. This is in addition to contracts for other fuses placed with the firm by the Admiralty two months ago.

Stepney.—The B.C. Electricity Department is purchasing 50 tons of moulded pitch from Messrs. Crow & Sons for £75.

L.C.C.—The Fire Brigade Committee received tenders as follows for the electric wiring and fitting of two fire stations:—

Waterloo Road Station.

G. E. Taylor & Co. .. .. (accepted)	£209.
W. J. Fryer & Co.	222.
Tilley Bros.	226.
W. Leonard & Co.	240.

Camberwell New Road Station.

John Barker & Co., Ltd. .. .. (accepted)	£140.
W. J. Fryer & Co.	168.
Pinching & Walton..	176.

Marylebone.—The B.C. has accepted the following tenders:—

Lea Recorder Co.—One Lea recorder, £70.
Crompton & Co.—One Crompton direct-current converter, £195.

Salford.—The T.C. has accepted the tender of Messrs. Bertram Thomas (Manchester) to supply and fit electric bells at Seedley Baths for £50 10s.

Shanghai.—The lamp contract mentioned last week was only part of that given out by the Shanghai Municipal Council. The agents of the General Electric Co., Ltd., in Shanghai, secured the order for 11,625 Osram and 4,850 Robertson lamps.

Sydney (N.S.W.).—Following the discussion in Sydney as to the type of turbines to install for the extensions, the final selection has fallen on Willans & Robinson turbines, and on Dick-Kerr alternators, at £44,547. Two units of 4,000 KW. each, running at 750 R.P.M., are to be installed. The prices included a 400-KW. unit in addition to the two 4,000-KW. units.

Wallasey.—The contract secured by Messrs. Imeson, Finch & Co., Ltd., to which we have already briefly alluded, is for the supply of material in connection with the Council's tramway extension of 3½ miles. It includes the supply of 326 poles, 7½ miles of trolley wire, and the necessary crossings, bonds, ears, &c.

Walthamstow.—The U.D.C. has accepted the following tenders for coal for the electricity undertaking:—

Rickett, Smith & Co.—750 tons of Ammanford coal, at £1 per ton.
A. Blackmore & Co.—750 tons of Ynisceedwyn coal, at £1 0s. 5d. per ton.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, December 3rd. At the Technical College, Glasgow. Discussion on "The Training of an Electrical Engineer," led by Messrs. F. A. M'Gowan and G. G. Cree.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, December 7th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Electric Cranes," by Mr. A. L. Hawes.

Institution of Civil Engineers.—Tuesday, December 7th. At 8 p.m. Paper on "Marine Propulsion by Electric Motors," by Mr. H. A. Mavor.

Association of Engineers-in-Charge.—Wednesday, December 8th. At 7.30 p.m. At St. Bride's Institute, E.C. Paper on "Recent Developments in Impulse Steam Turbines," by Messrs K. Andersson and E. Meden.

Saturday, December 11th. At 1.30 p.m. Visit to the Woolwich works of Messrs. Siemens Bros. & Co., Ltd.

Institution of Electrical Engineers (London).—Wednesday, December 8th. At 7.30 p.m. At the Hotel Cecil. Annual dinner.

Thursday, December 9th. At 8 p.m. At the Institution of Civil Engineers. Paper, "Notes on Methods and Practice in the German Electrical Industry," by Messrs. L. J. Lepine and A. R. Stelling.

Physical Society.—Friday, December 10th. At 8 p.m. Annual exhibition.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, December 6th.—"A" Company. Technical drill, 6.30 to 9.30 p.m.

Tuesday, December 7th.—"B" Company. Technical drill, 6.30 to 9.30 p.m.

Wednesday, December 8th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, December 9th.—"C" Company. Technical drill, 6.30 to 9.30 p.m.

Friday, December 10th.—"D" Company. Technical drill, 6.30 to 9.30 p.m.

Saturday, December 11th.—"C" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station, 3 p.m. Dress: Service dress with putties; belt, frog and arms; knife, fork, and toilet requisites will be carried in haversack; great coat will be worn overall. Tickets will be issued at the railway station by C.S. M. Paris.

(Signed) P. H. Campbell Capt. R.E. and Adjutant.
For O.C. E E., L.D.

NOTES.

National Electrical Manufacturers' Association (Incorporated).—The next Committee meeting of this Association will be held at Balfour House, Finsbury Pavement, E.C., on Tuesday, December 14th, at 2.30 p.m.

Concert.—A smoking concert was held on Wednesday last week to celebrate the fifth anniversary of the inauguration of the Smethwick Electricity Supply. It was held by the staff of the Smethwick and Oldbury Electric Light and Power Supply. A number of power-users in the area were represented, and Mr. Reilly (Muntz's Metal Co.) occupied the chair. During the interval the chairman proposed "Success to the Smethwick and Oldbury Electric Light and Power Supply." He mentioned that they started at the power station five years ago that day with one consumer, and they supplied 900 units; on the day of the concert they had 300 consumers, to whom they had supplied 31,000 units. He hoped that next year their consumers would be largely increased, and that they would sent out 60,000 units daily. Mr. R. W. Cramp, the general manager, in responding, said that in view of the anticipated increase, they were preparing to nearly double their plant.

Electrical Football League.—The second annual concert and distribution of trophies and medals takes place on Saturday, December 11th, at Brook Green Works, Hammersmith, by kind permission of the directors of Messrs. Robertson Electric Lamps, Ltd. We are informed that an excellent programme is being arranged.

Inquiries.—Correspondents wish to know where resistance wire of nickel-chromium can be obtained, and the composition of alundum; the makers of Gilsonite asphalt; makers of wire frames for silk shades; makers of appliance for measuring current density in different parts of a secondary cell.

Parliamentary. — Royal Assent.—Last week the Royal Assent was given to the Electric Lighting Act, 1909, and to the Colinton Tramways Order Confirmation Act.

Electric Searchlight Carbons.—Mr. Carlile asked Mr. McKenna, the First Lord of the Admiralty, on Wednesday whether the Admiralty purchased the greater part of the carbon for the electric searchlights of warships from Germany, and whether, in the event of the foreign supply not being available, manufacturers in this country would be able to meet a sudden demand. Mr. McKenna said the answer to the first part of the question was in the negative. The whole of the carbons purchased by the Admiralty for the searchlights of H.M. ships were made in this country. The answer to the second part of the question was in the affirmative.

The Japan-British Exhibition.—We have already done our utmost to impress upon British manufacturers the importance of their devoting very serious attention to the opportunity that will be afforded them next year of bringing their names and their products under the notice of the many Japanese and other foreign visitors who are expected at the Anglo-Japanese Exhibition at Shepherd's Bush. The importance of the event commercially has already been recognised by such firms as Messrs. Armstrong, Whitworth & Co., Messrs. Vickers, Sons & Maxim, Messrs. Platt Bros. & Co., and many others who have booked large allotments of space at the exhibition. It is hoped that there will be a good response from electrical and allied engineering firms who desire to promote new business relations on their own behalf, and—in the interests of the entire industry to co-operate in making the demonstration a thoroughly representative one of British machinery and apparatus. In the Machinery Hall the exhibits are to be purely British. For years Japan has bought very largely of our mechanical products. In all other portions of the buildings at the Great White City, in 1910, Japan will be demonstrating her commercial and intellectual progress, as well as her naval and military achievements. As Count Mutsu, Councillor of the Japanese Legation in London, has publicly declared: "Naturally, we shall try to invite your attention to some of our products, as yet unfamiliar to you, a knowledge of which may be to your interest and advantage, and if possible, to give an impetus to our exports to Great Britain, which are less than a quarter of your exports to us, and only one-fifth of our exports to the United States. Moreover, in doing this, we have the satisfaction of not competing with your home industries, seeing that the principal items of our exports to you—various species of rice, silk, copper, &c.—are articles which do not interfere with your own productions. We are not concerned with our exports alone, but with the other side of our trade with you."

Institution and Lecture Notes.—King's College Engineering Society.—The sixteenth annual dinner of the King's College Engineering Society took place on Saturday night at the Trocadero Restaurant; Prof. Capper occupied the chair, and the guest of the evening was Dr. Fleming, of University College.

Institution of Municipal Engineers.—The roll of the Institution now stands at 641 members and 92 students, making a total of 733.

The "Contract Demand" System.—The following letter has come to hand as we go to press:—

"I gather from your leader in this week's Review that the limiter system of charging for electric light is somewhat of a novelty in the old country, at which I am surprised, as it has been extensively used on the Continent for many years past. I venture to think, therefore, that the following information may be of interest to those who contemplate its introduction. Here, electric light is essentially the poor man's light; and no doubt this is partly due to the *à forfait* (contract) system of charging. During the last six months we have in this town connected 59 new installations of less than 10 (equivalent) 8-c.p. lamps apiece, and of these 10 have one 8-c.p. lamp only.

"Our charge per 8-c.p. lamp is 1s. per month for shops using the light till 10 p.m., and 1s. 5d. per month for all-night use. Apartments are only accepted at the all-night rate, as in their case control is difficult.

"Without a contract system it would be impossible to cater for these single-light consumers, because even with a 3-ampere meter (for which we charge 5d. per month) the rental would increase the cost of the light by 40 per cent., while the cost of consumption, if paid by unit, would probably largely exceed the contract price, as most of these small installations are long-hour consumers.

"Then the saving in capital expenditure is no small advantage—the cost of a limiter being 7s. or 8s., as against 37s. for a meter—while there is no expense in meter reading.

"Many companies, in addition to the limiter, have all the lamps sealed into special holders, the lamps having a different size of socket for each candle-power; but these are unnecessary complications as a good limiter can be depended on to cut out a 10-c.p. lamp, if set for an 8-c.p. The type of limiter which we use now exclusively, acts also as an automatic switch in case of a short circuit, thus saving the expense of a fuse.

"I shall be interested to read Messrs. Handcock and Dykes's paper.

"W. A. Brodie, M.I.E.E.

"San Remo, Italy.
"*November 29th*, 1909."

The limiter system is not new in this country, but has been very little used here. The prices obtained by Mr. Brodie would make our station engineers very happy; clearly, he has not to compete with gas at 2s. 2d.!

New Company.—As we go to press the Electrical Co., Ltd., inform us that the A.E.G. have disposed of their installation and consumers' business to a new company called A.E.G. Electric Co., Ltd., and that from January 1st the Electrical Co., Ltd., business will again be strictly wholesale, and they will confine themselves to the electrical trade exclusively, dealing only with electrical contractors, electric supply companies and electrical wholesale houses. All other business, including installation business, has been transferred to the A.E.G. Electric Co., Ltd.

Appointments Vacant.—Electrical fitter for H.M. Dockyard, Sheerness (34s.). Junior shift engineer for Bexley tramways department (27s. 6d.). Switchboard attendant for Eccles electricity works (24s.).—See our advertisement pages.

Manchester Engineering Exhibition.—The International Trade Exhibitions, Ltd., ask us to state that there is no foundation whatsoever for the rumour that the General Engineering Exhibition, of which they were appointed organisers at a meeting held some months ago, has been abandoned. The Exhibition will take place in the spring of 1911 in Manchester, and will last for six weeks. A special building will be erected early next year, which will be more than double the size of any existing Manchester building. Exhibitors will participate in the profits. The organisers will send out particulars early next year.

European Water Powers. — The *Elektrotechnische Zeitung* has made a partial estimate of the hydraulic power of the various European countries. According to it the horse-powers at the turbines available for nine months of the year are as follows:—

In the United Kingdom	963,000
Germany	1,425,900
Switzerland	1,500,000
Italy	5,500,000
France...	5,857,000
Austria	6,460,000
Sweden	6,750,000
Norway	7,500,000

Spain's position is not indicated, but it is probably between those of Italy and Switzerland. The horse-power of the United States is estimated at 150 millions.

Electric Power in Tasmania.—Addressing the members of the Royal Colonial Institute on Tuesday last week on "The Resources and Future of Tasmania," the Hon. J. McCall (Agent General) said that the vast water power available, which at present is only used in connection with the electric lighting scheme for the City of Launceston and a few minor works, promised to add great wealth to the country. There was a Bill before the State Parliament at the present moment to confer upon a company the right to harness the waters of a river into which the surplus water of three of the mountain lakes was to flow, to generate electricity for use in the treatment of complex ores and for other purposes. Mr. Rahbek, who was specially employed by the Government to investigate and report on the water power of the State, reported that from these particular mountain lakes there could be obtained 82,000 actual horse-power. There was nothing to stand in the way of Tasmania's becoming a great manufacturing centre, with her cheap power and healthy conditions for the people to work under.

Unemployed Plant.—Mr. I. J. Watson has drawn the attention of the *Financial News* to the large amount of unemployed plant installed in electric central stations. No less than 37 per cent. of the plant is "spare," the difference between the total capacity and the maximum demand being 293,000 KW., valued at £6,000,000. Undoubtedly the method of the future, says the journal, is to link up our town generating stations, and so avoid the necessity for multiplying spare plant. Mr. Watson takes a district surrounding Manchester as an example, and shows how, by merely joining mains, an additional 25,000 KW. could be undertaken without purchasing any new generating plant.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. W. S. HIND, of the sales department of the Marylebone undertaking, has been appointed assistant sales manager, at £4 per week without commission.

The Electricity Committee of the West Bromwich T.C. has recommended that the salary of the electrical engineer (MR. W. A. JACKSON) be increased from £300 to £350 per annum as from July 1st last.

MR. ALLAN SMITH, of the Stamford staff of the Urban Electric Supply Co., who is leaving for Newcastle-on-Tyne, has been presented by his colleagues with a clock in leather case.

MR. F. S. HININGS, of the Leeds Corporation Electric Lighting Department has been appointed chief junior assistant in the Commercial and Consumers' Department of the Birmingham Corporation Electric Supply Undertaking.

General.—With reference to our note of last week regarding an appointment at the steel works of Messrs. Beardmore, of Glasgow, we learn that MR. F. G. JOHNSON was recently appointed to be lighting superintendent of the works. Mr. J. Arthur Sykes is the firm's chief electrical engineer. We have pleasure in making this correction.

MR FRANK SYDNEY PATERSON has resigned his seat upon the board of Johnson & Phillips, Ltd.

MR. W. G. SCOTT, for some years resident engineer with the Brush Electrical Engineering Co, Ltd., at present with Messrs R. W. Blackwell & Co. on the London, Brighton & South Coast Railway electrification contract, which has just been completed from Victoria to London Bridge, has been appointed overhead superintendent to the above railway under Mr. E. J. Houghton, chief electrical engineer to the Brighton Railway.

MR. HERBERT E. MITCHELL, for many years chief engineer and manager of the late consulting practice of Messrs. Medhurst and Brewer, Victoria Street, has opened an office at 5, Victoria Street, Westminster, where he will continue to practise in consulting engineering work.

Our readers will regret to learn that MR. E. KILBURN SCOTT, a well-known electrical engineer and contributor to the ELECTRICAL REVIEW, was knocked down by a taxicab while crossing the Strand on Monday evening. He was conveyed to King's College Hospital, and as the result of inquiries, we are pleased to state that his condition is not so serious as was reported in the daily newspapers. We hope that Mr. Scott will have a speedy recovery and soon be about his accustomed duties again.

We congratulate MR. DUNCAN WATSON on his election to a seat on the Marylebone Borough Council. Electrical contractors, at any rate, will watch the situation with added interest.

In the offices of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, on Monday last, 29th ult., MR. BENJAMIN BISHOP was presented with an illuminated address, accompanied by a handsome and useful present, on the occasion of his having completed 50 years' service in the Silvertown works. The chair was occupied by Mr. Christian H. Gray, one of the principals of the firm, supported by Mr. P. M. S. Brodie, the works manager, and a large gathering of heads of departments and staff. The presentation was entrusted to Mr. William Wilson, one of Mr. Bishop's oldest colleagues, who remarked that the meeting was celebrating an auspicious event in honouring their esteemed and excellent fellow-clerk and comrade on his jubilee of service for the firm. Mr. Wilson closed a comprehensive and reminiscent speech by congratulating the recipient on his splendid health after such long service, adding that an occasion of this description was an object-lesson showing the amicable and friendly relations that existed, not only amongst the staff, but between employers and employed. Mr. Brodie endorsed the remarks of the previous speaker. Mr. G. K. Willsher also added a few remarks. Mr. Bishop, in responding, recalled his first appearance at the Silvertown Works, and gave some interesting details of his career. He expressed his personal gratification at Mr. Christian H. Gray's presence, and also that of so many old friends. Mr. Stables proposed a hearty vote of thanks to the chairman, which was received with acclamation. The chairman, in responding, remarked that, on having listened to the various speeches which had been made, he could only come to the conclusion that Mr. Bishop was held by his fellow-workers in the same high esteem that he felt for him personally.

NEW COMPANIES REGISTERED.

Electroscopes, Ltd. (105,933).—This company was registered on November 15th, with a capital of £4,000 in £1 shares, to erect and maintain premises for use as a skating rink, electric theatre or other public place of entertainment, &c. The subscribers (with one share each) are:—J. C. Genge, Hill View, Fanfare Road, Coulsdon, gentleman: G. Fabbro, 158, Falcon Road, Clapham Junction, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five: the first are G. Fabbro and J. C. Genge. Registered by J. F. Kelly, The Homestead, Sutton.

Silicaware, Ltd. (106,004).—This company was registered on November 18th, with a capital of £63,000 in £1 shares, to acquire interest in any patents relating to processes and apparatus for melting and electric furnaces, and for electrical fusing, refining and refractory purposes, to adopt an agreement with Dr. Wolf Burckhardt and others, and to carry on the business of manufacturers of, and dealers in, such furnaces and apparatus, and as fusers, refiners and moulders of silica, and ceramic substances, manufacturers of, and dealers in electrical appliances and apparatus; crucibles, &c. The subscribers (with one share each) are:—J. Schaefer, Hoechst am Alain, merchant; D. Franz Wolf-Burckhardt, Biebrich a/Rheim, chemist; E. Henss, Soden, i/Tannus, merchant; K. Huessener, Ravenscourt, Twickenham, merchant; P. F. Rouse, 85, Gracechurch Street, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are D. Wolf-Burckhardt, J. Schaefer, E. Henss and K. Huessener; qualification, £500; remuneration of J. Schaefer, £75 per annum, to be increased to £250 when more than 19 per cent. is paid on the ordinary shares. Registered by Cruesemann & Rouse, 85, Gracechurch Street, E.C.

Derwent Valley Electric Power Co., Ltd. (106,045).—This company has just been registered with a capital of £2,000 in £1 shares, to carry on the business of an electric power supply company in all its branches. The subscribers (with one share each) are:—P. C. Smith, 7, St. Helen's Place, E.C., solicitor; N. P. W. Brady, 7, St. Helen's Place, E.C., solicitor; A. S. Chetwood, 7, St. Helen's Place, E.C., solicitor; R. W. Fiddes, 18, Leyton Park Road, Leyton, clerk; G. E. Bird, Chestwood Cottage, The Vale, Hampstead, N.W., clerk; H. W. Martin, 41, Stanlake Road, Shepherd's Bush, W., accountant; W. R. Payne, 129, Elmhurst Mansions, Edgeley Road, Clapham, S.W., clerk. Registered without articles of association. The first directors are N. P. W. Brady and A. S. Chetwood. Registered by Minet, Pering, Smith and Co., 7, St. Helen's Place, E.C.

Ferabin Lamp and Electrical Accessories, Ltd. (106,073).—This company was registered on November 23rd, with a capital of £15,000 in £1 shares, to adopt an agreement with A. Wedekind for the acquisition of the benefit of a certain existing invention, and to carry on the business of electricians, gas and mechanical engineers, manufacturers of and dealers in lamps and electrical accessories, suppliers of electricity, &c. The subscribers are:—J. S. Sommer, 20, Bucklersbury, E.C., merchant, 250 shares; A. E. Rice, 20, Bucklersbury, E.C., secretary, 1 share; L. Ridout, 26, Dorset Square, N.W., electrical engineer, 250 shares; J. W. W. Agnew, Lyndale, Turnpike Lane, Hornsey, iron merchant, 650 shares; J. G. Riadore, 100, Piccadilly, W., gentleman, 200 shares; W. H. Herod, 17, Frinton Road, Stamford Hill, 1 share; H. J. Wright, 69, Black Boy Lane, Wood Green, N., engineer, 1 share. Minimum cash subscription £1,550. The number of directors is not to be less than three or more than seven; the first are J. S. Sommer, L. Ridout, J. W. W. Agnew, and J. G. Riadore; qualification 200 shares; remuneration after 5 per cent dividend has been paid, £50 each per annum and 5 per cent. of the surplus profits, divisible. Registered office, 266, Mansion House Chambers, 11, Queen Victoria Street, E.C.

Madeira Electric Lighting Co. (1909), Ltd. (106,123).—This company was registered on November 25th, with a capital of £30,000 in £5 shares, to acquire from the Receiver for the debenture-holders of the Madeira Electric Lighting Co., Ltd., the concession granted to the said company by the Municipal Corporation of the City of Funchal, Madeira, to acquire from the said Receiver the property and assets of the said company under an agreement dated July 23rd, 1909, and to carry on in Funchal aforesaid the business of an electrical supply company in all its branches. The subscribers (with 50 shares each) are:—H. Hirst, 71, Queen Victoria Street, E.C., electrical engineer; H. Kahn, 75, Lombard Street, E.C., merchant; G. T. Moody, Lorne House, Dulwich, doctor of science. A. I. S. Basen, 71, Queen Victoria Street, E.C., engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. Hirst, G. T. Moody and H. Kahn; qualification (except local advisory director), 50 shares; remuneration as fixed by the company. Registered office, 75, Lombard Street, E.C.

CITY NOTES.

Allgemeine Elektricitäts Gesellschaft.

THE report of the directors for the year ended on June 30th, 1909, states that the company had extremely abundant funds at disposal, also during the recent critical period in the money market. The danger of an electricity tax had been averted, and illuminating articles only were taxed as from October 1st, 1909, but electrical sources of light had now been so greatly improved that notwithstanding the tax, considerable economies were possible, as compared with former times. As to electric railways, the Minister of Public Works was disposed in principle to grant a concession for an interurban line between Cologne and Dusseldorf, for which the company exerted itself as far back as 1904, in conjunction with a friendly firm. The Electrical Bank (Elektro-Treuhand Gesellschaft) formed in November, 1908, had reserved the beginning of activity to a later period in view of the provisional postponement of large works by private enterprise. The volume of the turnover in the past year had never previously been recorded, a fact which was all the more noteworthy as the sale prices were depressed, and the results could be regarded as wholly satisfactory. As the open reserves alone had been increased to £2,500,000, and, therefore, reached one half of the share capital, and as the situation of business had recently improved, the directors had been induced to raise the dividend from 12 to 13 per cent. As in all previous years, the distribution was effected without drawing upon the inner reserves, or the profits from the sale of securities. The company employed 33,056 persons on July 1st, 1909, as compared with

32,035 on the corresponding date in 1908, and the increase rendered it necessary for extensions to be made in all the works, which would mostly be completed in the new financial year. Excepting the motor-car factory, which suffered from the general depression in this branch, the works for the construction of steam turbines, high-tension apparatus and metallic-filament lamps had developed favourably beyond expectation. The accounts show the following results for the past year, the figures for 1907-8 being added for the purpose of comparison:—

	1908-9.	1907-8.
Share capital	£5,000,000	£5,000,000
Gross profits	933,600	891,700
Administrative expenses ...	25,490	23,370
Taxes	82,000	64,300
Depreciation provision	23,400	20,900
Net profits...	819,200	796,500
Reserve fund	63,300	50,000
Bonuses to officials, &c.	32,500	30,000
Pension fund	32,500	80,000
Dividend	650,000	600,000
„ per cent.	13	12

The output of the dynamo works comprised 47,351 machines and transformers of a total of 912,374 KW., as contrasted with 47,726 and 993,842 KW. and 43,953 and 854,543 KW. in the two preceding years respectively. Orders for large machines were less numerous than formerly, but the demand for small and medium sizes increased. Dynamos and motors of large dimensions and outputs were carried out for water-power, winding, electro-steel and rolling mill installations. Interesting innovations were the parallel switching of alternating-current stations of varied periodicity, adjustable A.C. motors for spark telegraphy, and high-speed motors for the direct driving of compressors for variable quantities of air; also direct-current machines of medium output with sparkless commutation and economic utilisation of material, rotary converters with auxiliary poles and machines for the welding of rails and for foundries. Equipments for tramways had lost their former importance since the requirements in this respect appeared to be substantially satisfied. On the other hand, new types had been developed for city, overland and main lines, and large locomotives on the company's alternating-current system had been constructed both for home and abroad. The number of locomotives delivered was 184, as compared with 146 in 1907-8, and the arrival of fresh orders was satisfactory.

The report proceeds to state that the turbine factory was fully employed, and the value of the product again increased, although the sale prices were considerably reduced. New orders were also satisfactory, and the construction of turbine blowing engines had been undertaken on the presumption that this branch would offer a sufficient market. The turbines for three torpedo boats had been delivered, and the trials of the boats had yielded brilliant results. Numerous orders for units up to 18,000 H.P. had already been received, and a large building was being completed to deal with the large sizes efficiently. After referring to the apparatus factory, the micanite factory and the railway signal factory, the report mentioned that the Oberspree cable factory worked up 19,573 tons of copper, or only 600 tons less than in the year of greatest production, and large quantities of cables had been delivered for working pressures up to 20,000 volts. The extraordinary fall in the price of aluminium had rendered possible the use of this metal for the telephone service, as well as for heavy currents. The deliveries of carbon-filament lamps from the lamp factory were about on the level of the previous year; and considerable quantities of metallised carbon filaments were also supplied. The metallic-filament lamp had reached a high stage of perfection, and sales had increased almost three-fold and were further advancing. As to light and power work, the requirements of the ironworks, notwithstanding the ordering of fewer large dynamos and motors, still reached a noteworthy figure, as the leading works continued to endeavour to combine scattered sources of production and reduce the cost of energy by the installation of large units working economically, and they gave preference to steam turbines as compared with the limits placed on the size of gas engines. The superiority of electrical driving of rolling mill trains seemed to have so far been recognised that the company had equipped 200 trains, representing more than 250,000 H.P. The inland mining industry also manifested reserve, the orders being mainly limited to equipments for the maintenance of shafts, and out of the 26 orders for main shaft winding plant obtained during the year, 23 were for foreign mines.

Apart from the work carried out for the Berlin Electricity Works, the company undertook central station and extension works during the year of a total output of 161,415 H.P., as contrasted with 153,450 H.P. in 1907-8, and the length of the cables and conductors laid was 858 miles. Similar work was in progress representing 328,860 H.P. and 560 miles, as against 263,225 H.P. a year ago. Among the completed orders was that of 22,500 H.P. for the Victoria Falls and Transvaal Power Co., and a further order for 150,000 H.P. for the same company had been received in association with a friendly company. The report, in referring to electric railways, remarks that the Prussian State Railway Administration had ordered the equipment of 17 further alternating-current motor-coaches for the suburban traffic from Blankenese, *via* Hamburg, to Ohlsdorf, making a total of 96 equipments supplied to this railway. A proof of the increasing introduction of the alternating system on railways lay in the beginning of orders for locomotives. One locomotive was being built of 600 H.P. for the Prussian State, one of 1,600 H.P., for the Chemins de Fer du Midi in France and a similar one for the Berne Alpine Railway Co., in Switzerland. Other alternating lines mentioned are the sections Carlsruhe—Herrenalb, Pamplon—Sanguesa, in Spain; Naples—Piedimonte, in Italy; Padua—Fusina; and the South London line of the London, Brighton and South Coast Railway. The working of storage battery cars satisfied the Prussian State railways who had ordered 10 further equipments, and also three benzol-electric coaches, after making lengthy trials with the first of this type. Tramway business was restricted almost entirely to extensions of existing lines, but the operation of suburban railways by means of high-pressure continuous current was beginning to develop with good prospects. The order for the equipment of the Frankfort local railway was being carried out in conjunction with a local electricity company.

The report further deals with the company's investments and transactions in securities, &c. It is mentioned that the book value of the securities, apart from those acquired as temporary investments, such as Imperial and Prussian loans, &c., yielded interest of 9·71 per cent. which would be brought into the new financial year. The increase in the bank credit by £1,271,000 to £2,965,000 was connected with the sale of securities and the payments made on the £750,000 of 4½ per cent. debenture bonds issued in July, 1908, whilst 4 per cent. bonds of £1,824,900 were previously in existence. The pension fund capital stood at £400,400 at the end of the financial year, and the legal burdens imposed by the sick, invalid and accident insurance involved an expenditure of £53,170 during the year.

Richard Hornsby & Sons, Ltd.—The directors recommend a dividend on the ordinary and new shares for the year ended September 30th, at the rate of 6¼ per cent. per annum, placing £10,000 to reserve. £5,084 is carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended October 29th, 1909, were 686,302, compared with 530,850 units in the corresponding four weeks of 1908.

United Electric Tramways of Monte Video, Ltd.—The directors have declared an interim dividend of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares of the past half year.

Phospor-Bronze Co., Ltd.—Petitions for the winding up of this company were before Mr. Justice Swinfen Eady in the Companies' Court on Tuesday last. Mr. Clawson, representing the petitioner, stated that arrangements were being made with the creditors, or at any rate, negotiations were going on, and with the consent of all parties, he asked that the matter might be allowed to stand over for a fortnight in order to permit the negotiations to come to a head. His Lordship sanctioned an adjournment for 14 days.

Canada.—According to the Toronto correspondent of Canadian Agency, Ltd., application has been made at Ottawa for the incorporation of the Quebec Railway, Light, Heat and Power Co., which will include the following companies: Quebec Railway, Light and Power Co., which operates the city and suburban electric railway services and supplies electric light and power and controls the Montmorency Power Co.; the Quebec Gas Co., in which Toronto and London, Ont., capitalists are interested; the Frontenac Gas Co., which is a competing concern controlled by American capital; and several power companies, including the Jacques Cartier, the Seven Falls, and the Canadian Electric Power Companies. The details have not yet been completed.—*Financial News.*

Provincial Tramway Co.—It is stated in the *Times* that the directors recommend, subject to final audit, for the year ended September 30th, a final dividend of 4s. per share, making 7s. for the year. They have set aside £8,000 for reserve and depreciation in respect of various undertakings, the property of the company, and £500 towards writing off the expenses of the issue of debenture stock. The amount brought forward was £3,060, and £2,686 will be carried forward.

Continental.—BELGIUM.—The report of the Compagnie Belge d'Electricite Siemens-Schuckert, of Brussels, for the last financial year shows a net profit of £1,624; a dividend at the rate of 7 per cent. is being declared as compared with 6 per cent. in the preceding 12 months.

GERMANY.—The Rheinische Schuckert Gesellschaft für Elektrische Industrie, of Mannheim, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

The balance-sheet of the Siemens & Halske Co., of Berlin, for the last financial year, shows a net profit of £571,450; a dividend of 12 per cent. is being declared, as compared with only 11 per cent. for the preceding 12 months.

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—£75,000 6 per cent. cumulative preference stock.

Shawinigan Water and Power Co.—Further issue of £205,597 4½ per cent. perpetual consolidated mortgage debenture stock.

Prospectus.—*Dennistown (Krian, F.M.S.) Rubber Estates, Ltd.*—An issue of 100,000 shares of £1 each has been offered for subscription.

British Columbia Electric Railway Co., Ltd.

The directors' report for the 12 months to June 30th, 1909, says that the gross receipts show an increase of $339,699, or 17 per cent., and the net earnings, including income from investments in subsidiaries, and after charging renewals, show an increase of $18,792, or 5·6 per cent. over those of the preceding year. From June 30th, the close of the financial year under review, up to October 31st last, there has been a still further increase in gross earnings of $231,961, or 32 per cent., and in net earnings of $98,086, or 28 per cent. From January 1st, the company, in pursuance of its long-established policy of allowing the public to share in its prosperity by treating them in the most liberal manner possible, spontaneously reduced its charges for electric light by about 17 per cent. The rates now charged compare favourably with those of the largest cities of Canada. Various reductions in railway fares and charges have also been made during the year. It was anticipated when these reductions were put into force that they would involve considerable diminution of profits, but the increase in the volume of business has more than compensated for the reduced charges, and the above-mentioned satisfactory results are shown for the whole year. The following charges have been made against the revenue account of the year, viz.:—Provision for renewals maintenance (from which £16,675 has been deducted for adjustments and expenditure on renewals during the year), £36,448; bonus to employés, £9,684; amount added to capital amortisation fund, £2,018. Net profit for the year, after making the above deductions, £163,306. Add balance brought forward from last year, £4,974 = £168,280. The following are deducted: Interest on debentures and debenture stock to June 30th, 1909, £39,889; dividends already paid—on 5 per cent. cumulative perpetual preference stock for the year ended June 30th, 1909, £20,000; on preferred ordinary stock for the year ended June 30th, 1909, £24,000; and on deferred ordinary stock for six months to December 31st, 1908, £20,000 = £103,889, leaving available for further distribution and reserves, £64,391. From this the directors have decided to recommend the payment of a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months to June 30th, 1909, making 8 per cent. for the year, £20,000; to transfer to reserve fund, £37,330, and to carry forward to next account, £7,061. There has been deducted from the reserve fund the sum of £25,268, representing the difference between the net amount realised by, and the par value of, £500,000 4½ per cent. debenture stock issued in November, 1908, and there has been added to the reserve fund £10,000, representing the premium on £100,000 5 per cent. preference stock and £100,000 deferred ordinary stock issued in June, 1908. After the transfer now recommended by the directors as above, the reserve fund will stand at £160,000. The number of lights in use at June 30th, 1909, was 347,026, an increase for the year of 59,402. The number of passengers carried during the year was 25,183,739, an increase for the year of 3,855,559. From the foregoing figures, it will be seen that the company's business has again increased very largely during the year. Although the directors have every confidence that the business will continue to increase steadily in the future, they point out that the extraordinary increase in earnings of the last few months is attributable partly to exceptional causes. The Exhibition at the neighbouring City of Seattle has attracted thousands of tourists, who have visited Vancouver and Victoria, besides which the great salmon run (which occurs every fourth year) has this year largely increased the earnings of the Lulu Island branch.

The great influx of settlers into the Province of British Columbia is indicated by the fact that the permanent population of Vancouver City alone is now reliably estimated at over 100,000. As a natural and necessary result of this growth, which the directors, after most careful examination of conditions, are satisfied will continue, the company is extending its railway system and general undertaking as the interests of the country and the public requirements of the public demand. The new lines of railway may not prove immediately remunerative, and must be expected to increase the ratio of expenses during the next two or three years, but they will undoubtedly in time develop a very valuable business. During the year £286,182 has been spent in extensions and improvements. Very satisfactory progress has been made with the construction of the Fraser Valley branch to Chilliwack (65 miles), and it is estimated that the first section, 21 miles, to Cloverdale will be open for traffic towards the end of this month, and a further section, 22 miles, to Abbotsford will be in operation towards the end of January, the whole line being completed and in operation some time during the spring of next year. The opening of this line is eagerly looked for by the settlers in the districts through which it runs, and the prospects of traffic are good. Various extensions of the company's system in the districts adjacent to Vancouver and New Westminster have been undertaken, aggregating altogether about 31 miles of railway. The company has also built a short new branch line from Victoria City. When these extensions are completed, the company will be operating 164 miles of line.

In view of the demand for electrical energy, an increased supply of water power in the future has had to be considered. The directors, acting on the highest scientific advice, have authorised the construction of a new dam of greater height at Lake Coquitlam, and also the enlargement of the tunnel between Lake Coquitlam and Lake Buntzen. It is estimated that this will enable the plant at Lake Buntzen to be gradually increased to about 62,000 H.P., which should satisfy the requirements of Vancouver and the neighbourhood for years to come. At the present time the plant at Lake Buntzen is capable of generating 22,500 H.P., and an additional unit of 10,500 H.P., which is in course of erection, will be available within a few weeks. It has also become necessary to increase the supply of power for the City of Victoria, but before undertaking the large capital expenditure for this purpose the directors entered into negotiations with the city, which have resulted in a satisfactory agreement, protecting the company from municipal competition. The development of a large water power on Jordan River is now in progress, and the directors are advised that it will when completed adequately meet the requirements of the City of Victoria for many years to come, while it will also enable the company largely to extend its business.

The construction of the new freight sheds has been completed. Plans are also being considered for new terminal buildings which will be in every way worthy of the City of Vancouver and of the company. They will, moreover, enable considerable economies to be effected in the general administration of the company's business.

It has also become necessary to largely increase the company's equipment for the construction of rolling stock. The output from the company's existing workshops is satisfactory, both as to quality and cost, but with the present accommodation it is quite impossible to produce the new rolling stock required, or to deal efficiently with the requisite overhauling and repairs. The directors are, therefore, considering the advisability of moving the car shops to a more convenient and commodious site and of erecting workshops of large capacity, built and equipped in the most modern manner.

The directors regret to announce that the Sumas Reclamation Scheme, to which they referred in their last report, has had to be abandoned, as after a prolonged and careful examination, based on extensive test works, the revised estimates of cost proved to be prohibitive.

It is with great pleasure that the directors record their very high appreciation of the efforts made by the officers and staff in British Columbia, and their satisfaction with the excellent relations which continue to exist between the company and its employés.

In pursuance of the board's policy of maintaining a close personal supervision of the company's business, two of the directors, Mr. T. Blundell Brown and Mr. A. C. Mitchell-Innes, have spent several months in British Columbia inspecting the company's property and studying local conditions. Their reports fully confirm the favourable opinions already expressed as to the future of the province and of the company's undertaking.

The directors deeply regret to record the death of Mr. B. K. Sperling, who had been associated with the company from its inception, and to whose clear judgment and devotion to its affairs in its earlier days the company is greatly indebted. The vacancy thus created has been filled by the appointment of Mr. A. C. Mitchell-Innes, who was one of the company's first directors.

Adelaide Electric Supply Co., Ltd.

The directors' report for the year ended August 31st, 1909, states that with the sanction of the preference and ordinary shareholders, the unissued balance of 3,000 preference shares were issued during the year at a premium, the bulk of the shares having again been allotted to local applicants in Adelaide. The premiums received on the issue, amounting, less brokerage, &c., to £993, have been applied in reduction of suspense account. The profit and loss account shows a credit balance for the year of £24,260. After payment of the dividend on the preference shares for the half-year ended February 28th, 1909, there remains, including the amount carried forward from the previous year, an available balance of £20,831, which the directors recommend should be applied as follows:—To dividend on 30,000 6 per cent. preference shares for the half-year ended August 31st, 1909, paid on September 1st, 1909, £4,500; to dividend at the rate of 6 per cent. per annum on 26,065 ordinary shares for the year ended August 31st, 1909, £7,815; to amount to extinguish suspense account, £1,507; to amount transferred to depreciation account, £1,000; to amount transferred to dividend equalisation account, £5,000; to balance carried forward, £1,009—£20,831. During the year, a further sum of £40,156 was expended on capital account in the provision of additional land, buildings, plant and mains. The company's mains have now been carried into the majority of the extensive residential and manufacturing districts surrounding the City of Adelaide. The directors are glad to say that this policy of energetic development of areas promising a reasonable demand for electric light and power, is being fully justified by results. The temporary supply of power to the Adelaide Municipal Tramways Trust was commenced in March last, and is being maintained satisfactorily. The directors recommend that a portion of the profits during the continuance of this supply be transferred to a dividend equalisation account. The following table sets out in detail the progress made by the company during the past three years:—

Date.	Lighting in 8-c.p. lamps.	Motors in rated H.P.	Total connections in 8-c.p. lamps.	Total units sold.
August 31st, 1907 ..	56,964	1,431 H.P.	102,756	1,384,178
August 31st, 1908 ..	71,138	1,837 H.P.	129,922	1,666,974
August 31st, 1909 ..	91,338	2,369 H.P.	167,146	2,073,550*

* Excluding traction units sold to the Municipal Tramways Trust.

Castner-Kellner Alkali Co., Ltd.—Presiding at the annual meeting held at Cannon Street Hotel on 25th ult., the Right Hon. G. W. Balfour congratulated the shareholders upon the financial statement. The net profit, after the usual expenditure on maintenance, amounted to £134,154, before deducting debenture interest and depreciation. It represented an increase of £18,000 over the net profit of the previous year. The increase arose on almost every product that the company turned out. The net balance available was £117,711. They had raised the amount put to general depreciation from £30,000 to £35,000. They were carrying £25,000 to the general reserve fund started last year. They were paying a further 9 per cent., making the dividend 14 per cent. for the year, carrying forward £15,840. He saw no reason why the accounts for the current financial year should not be equal to those now presented. The chemical trade seemed to be improving.

Mackay Companies.—The directors have declared a quarterly dividend of 1¼ per cent., or at the rate of 5 per cent. per annum, on the common shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc
Aberdeen	Nov. 24	2,280	— 85	25	36,686	— 845	..	..
Ayr	,, 27	330	— 30	28	9,613	— 125	8	..
Bath	,, 24	1,225	— 55	47	36,371	+ 1,315	..	..
Belfast	,, 26	6,970	— 119	33	181,807	— 5,193	37	..
Birkenhead	,, 28	1,850	— 178	34	37,054	— 554	13·63	..
Birmingham Corp.	,, 20	13,184	+ 406	34	221,893	+ 6,479	56·5	..
Blackburn	,, 24	2,058	+ 63	35	38,962	— 1,212	13·97	..
Blackpool	,, 25	678	..	..	48,637	+ 4,102	..	..
Blackpool-Fleetw'd	,, 27	418	— 52	21	21,836	+ 1,372	..	..
Bolton	,, 21	4,815	+ 87	34	79,788	+ 214	26	..
Bournemouth	,, 24	2,451	— 88	34	59,410	+ 332	21·72	..
Bradford	,, 20	9,108	+ 424	33	165,692	+ 5,224	54·61	..
Brighton	,, 28	1,392	— 87	35	35,408	+ 1,580	9·5	..
Bristol	,, 26	9,901	+ 406	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Nov. 19	423	— 20	46	10,109	— 112	3·65	..
Barnsley	,, 19	330	— 9	,,	7,784	— 384	..	..
Barrow	,, 19	406	— 9	,,	10,749	— 594	5·37	..
Cavehill	,, 19	118	— 8	,,	3,998	— 100	..	..
Devonport	,, 19	668	— 245	,,	17,015	— 4,469	8·85	..
Gateshead	,, 19	1,964	+ 3	,,	45,945	— 525	11·25	..
Gravesend	,, 19	384	+ 38	,,	9,764	— 3	6·5	..
Greenock	,, 19	998	+ 67	,,	25,729	+ 1,466	7·25	..
Hartlepool	,, 19	482	+ 42	,,	10,919	— 103	6·72	..
Kidderminster	,, 19	173	+ 13	,,	4,938	— 167	..	..
Leamington	,, 19	275	— 77	,,	8,203	+ 157	..	..
Merthyr	,, 19	359	— 81	,,	9,719	— 121	2·9	..
Metropolitan	,, 19	11,910	+1,171	,,	288,072	+21,746	22	..
Middleton	,, 19	559	— 1	,,	15,502	— 934	8·5	..
Mid. Joint Com'tee	,, 19	11,317	+ 315	,,	264,106	— 871	..	..
Oldham—Ashton	,, 19	1,094	+ 58	,,	25,967	— 1,178	9·13	..
Peterborough	,, 19	203	+ 3	,,	5,504	— 430	5·31	..
Potteries	,, 19	3,781	+ 156	,,	82,934	— 484	29	..
Rothesay	,, 19	71	— 14	,,	2,772	+ 126	2·75	..
Southport	,, 19	430	— 32	,,	13,360	— 425	8·17	..
S. Metropolitan	,, 19	1,431	+ 42	,,	37,035	— 557	..	..
Swansea	,, 19	1,879	+ 49	,,	45,105	+ 1,407	12·5	..
Tynemouth	,, 19	808	+ 30	,,	11,415	+ 335	3·75	..
Weston-s-Mare	,, 19	70	+ 6	,,	7,065	+ 397	3	..
†Worcester	,, 19	450	— 17	,,	12,955	— 134	5·75	..
Wrexham	,, 19	175	— 9	,,	4,553	— 193	..	..
Yorks. Wool. Dist.	,, 19	1,851	+ 157	,,	42,620	+ 360	17	..
Miscellaneous	,, 19	379	+ 29	,,	9,697	+ 228	..	..
Burnley	,, 27	2,211	+ 134	..	..	..	..	..
Burton-on-Trent	,, 28	454	— 26	35	9,310	— 241	6·63	..
Bury	,, 28	1,928	— 162	34½	40,935	— 881	22·5	..
Cardiff	,, 20	3,964	— 19	34	75,452	+ 1,110	..	..
Carlisle	,, 27	255	— 62	47	7,783	— 427	..	..
Chatham and Dist.	,, 25	1,593	— 51	47	38,799	+ 1,599	14·98	..
Cork	,, 25	773	— 108	47	21,207	— 627	9·89	..
†Croydon	,, 12	1,580	+ 346	..	51,783	+ 4,316	11·25	4·75
Darlington	,, 27	360	— 29	35	6,482	— 487	..	..
†Darwen	,, 19	259	+ 5	33	8,406	+ 135	4·36	..
Dover	,, 20	303	— 9	34	7,454	— 419	4·75	..
Dublin	,, 26	9,305	— 147	..	119,174	+ 1,864	54·25	..
Dundee	,, 24	2,145	— 75	27½	32,975	— 657	15	..
East Ham	,, 27	1,736	+ 3	34½	35,043	+ 4,315	8·52	·77
Exeter	,, 26	478	— 89	35	17,898	+ 566	..	..
Glasgow	,, 27	30,943	—2,247	..	436,429	— 7,501	94½	5
Hastings	,, 25	1,392	— 27	..	..	..	..	..
†Huddersfield	,, 20	1,525	+ 105	33	56,422	+ 2,965	28·5	·5
Hull	,, 27	5,052	+ 269	34	89,391	+ 3,310	14·5	1·5
Ilkeston	,, 24	280	— 4	34	4,685	— 245	..	..
Ipswich	,, 27	597	— 2	35	14,943	+ 143	10·5	..
Kilmarnock	,, 20	253	— 25	27	4,022	— 148	4·25	..
Lancashire United	,, 24	2,259	— 118	47	64,009	— 766	..	..
Leeds	,, 20	12,836	+ 478	33	231,025	+ 6,170	..	..
Leicester	,, 27	4,057	+ 109	..	..	..	..	..
Leith	,, 20	1,037	+ 84	27	16,901	+ 2,099	..	..
Liverpool	,, 20	20,902	+ 219	46	497,183	— 1,758	..	..
†L.C.C.	,, 13	75,685	+6,143	..	1,206,557	+52,202	..	..
London United	,, 20	9,814	— 688	..	285,813	—28,948	..	..
Lowestoft	,, 27	308	— 4	9	1,446	— 10	3·5	..
Manchester	,, 27	27,446	—1,000	35	521,827	— 7,666	..	..
†Newcastle	,, 20	3,710	— 137	..	131,185	— 1,339	14·5	..
Newport	,, 20	1,158	— 56	34	22,403	— 312	14·5	..
Oldham	,, 28	3,033	— 685	35	65,870	— 4,564	23·75	..
Pontypridd	,, 27	758	+ 16	34½	14,384	+ 1,065	5·5	..
Portsmouth	,, 27	3,071	— 94	35	75,007	+ 2,252	14·5	..
Preston	,, 24	1,263	— 93	..	..	..	..	..
Rotherham	,, 25	1,027	— 97	34	20,253	— 1,049	10	..
Salford	,, 22	8,339	— 140	33½	155,073	— 4,354	..	..
Sheffield	,, 28	10,856	+ 268	35½	199,890	+ 1,348	..	..
Southampton	,, 24	1,763	— 92	34	37,206	— 969	..	..
Southend-on-Sea	,, 24	704	+ 5	34	19,293	+ 2,526	..	..
South Shields	,, 27	1,008	+ 16	34½	19,768	— 40	..	..
Swindon	.. ..	..	..	..	..	..	..	..
Tyneside	,, 24	729	+ 25	21	9,254	+ 329	..	..
Wallasey	,, 27	1,468	— 114	34½	32,476	+ 688	..	·22
Walthamstow	,, 27	1,048	+ 19	35	23,302	+ 436	9	..
West Ham	,, 16	4,906	+ 195	33	78,572	+ 4,791	15·25	·43
Wolverhampton	,, 24	1,597	+ 86	34	28,693	— 1	14·25	1·75
Baker St.-Waterloo	,, 27	6,910	+ 725	21	65,270	+ 1,585	4·25	..
Cen. London Rly.	,, 27	11,730	+ 192	21	110,196	—43,077	6·32	·55
Char. +, Bus. Hamp.	,, 27	7,895	+ 970	21	78,830	+ 8,240	7·75	..
City & S. Lon. Rly.	,, 28	6,758	+ 516	21	65,856	+ 2,360	7·3	..
Dublin-Lucan Rly.	,, 26	201	— 18	21	3,132	+ 58	7	..
G.N. and City Rly.	,, 27	2,988	+ 102	21	28,044	+ 151	3·5	..
G.N., P'y. & Brmtn.	,, 27	12,886	+1,265	21	111,780	+ 4,455	9·25	..
L'pool Overh'd Rly.	,, 28	2,547	— 84	..	30,804	— 26	6·8	4·8
Llandudno-Col. Bay	,, 26	214	— 4	52	14,212	+ 2,196	..	..
Mersey Railway	,, 27	4,149	+ 284	21	40,955	+ 1,662	4·5	..
Metropolitan Rly.	,, 28	34,007	+1,564	..	338,400	— 3,949	24·5	..
Met. District Rly.	,, 27	21,599	+2,114	21	206,755	+10,558	24	..
Anglo-Argentine	,, 25	82,298	+3,332	..	1,854,401	+111,678	..	..
§Auckland	,, 5	13,452	+1,157	44	149,953	+13,607	22·8	1·38
Bombay (B.E.T.)	Oct. 28	5,361	— 142	42	108,278	+ 5,447	..	..
§Brisbane	,,	16,775	+1,365	..	..	..	..	..
§Brit. Columbia Rly.	.. ..	..	..	..	..	..	..	..
Calcutta	Nov. 27	6,814	+ 919	..	..	..	..	..
§Cape Electric T. Ld.	.. ..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Oct.	3,530	..	..	38,078	..	20·5	..
Madras	Nov. 15	1,989	+ 220	..	27,083	+ 1,156	..	..
§Melbourne	.. ..	..	..	..	..	..	..	..
§Lisbon	.. ..	..	..	..	..	..	..	..
Perth (W.A.)	Nov. 26	2,810	+ 47	..	65,826	+ 833	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

With a breath of hope in money getting cheaper, the Stock Exchange atmosphere has become more clear, and business to some extent has revived, carrying prices with it. Unfortunately, the political tension acts like a drag upon activity, and the average business man curses both parties alike for setting up their differences in the commercial arena. He demands why, in the name of reason, matters vital to national welfare cannot be explored, discussed and argued on some higher plane than the platform of mere party politics, where, in the clash of strife, the unloosing of bitterness and the trifling with truth, the public weal plays a very subdued accompaniment to the chorus of contention.

Reverting from the mundane to the germane, it may be said that electrical issues are steadily firm, without especial feature. The printing presses pour out more and ever more prospectuses of new rubber companies.

A severe slump in copper shares has followed reports that the suggested United States combine of copper companies may fail to come to cohesion. A recovery in Consols has helped in a slight degree the prices of Home Railway stocks.

Underground Railway stocks were almost strong for a few days, but the firmness did not last. Metropolitan Consolidated and District Ordinary, however, have retained part of their improvements. The opening of the Brighton Company's newly electrified section for traffic this week has helped the Deferred stock to a rather better level. Great Northern and City Preferred fell into further disgrace, and went back to 15s. The Debenture stocks of the Tube amalgamating lines are unchanged, and Underground Electric Railways of London issues show no alteration.

London United Tramways Debenture stock continued to slide, a further 2 points being knocked off the price this week; the stock has changed hands as low as 63½. British Electric Traction second Debenture rose 1, and the shares have held their recent rises. The company's scheme for farthing fares is, at all events, novel. The foreign tramway issues are generally good. Anglo-Argentine Fours show a gain of ½, and Auckland 5 per cent. Debenture has hardened to 104½. British Columbia Electric Railway stocks are slightly easier. Rios declined a shade to 94½. Kaministiquia Power 5 per cent. gold bonds are better.

Continued improvement in Smithfield Markets Electric Supply Ordinary shares is the feature in their own department, the company having secured an extension of their concession to 1972. The price has put on 10s, and stands now at 30s. middle, having more than doubled in less than a fortnight. "City Lights" are ⅛ down, bringing their lower price just under par. The South Metropolitan has opened an "electric house" in its district, designed to illustrate the manifold uses to which electric power may be applied in ordinary domestic matters. The idea appears to be excellent, and capable of extension. In the provincial list, Hove shares have slipped back again to 7, while Newcastle-on-Tyne Preference at 4½ are 5s. better.

Investors are having pressed upon their attention more particularly three classes of shares at the present time—rubber, rinkeries and electric theatres of different kinds. The latter cater for the million, and on a small capital, a well-managed concern in a populous district can do extremely well. It is very necessary, however, that capitalists should make searching examination of the prospectuses of such concerns, which must, in the nature of things, be highly speculative, depending as they do upon the whim and passing fancy of the multitude, for whose benefit some competitive form of entertainment is bound to be provided sooner or later.

Considerable dealings in Babcock & Wilcox Ordinary have left the shares $\frac{1}{16}$ better at 4⅝. Beyond this, the manufacturing list is quiet, and there are no quotable movements of importance. Rubber shares keep very steady, and the result of the fluctuations of the past week has been to advance prices in the majority of cases. And still the new companies come!

Telegraph stocks and shares are somewhat irregular. Eastern Ordinary, with a gain of 2½, shows the largest movement, Eastern Extensions remaining at 12. Great Northerns are good, and Western Telegraphs are ½ up. The dividend of 20s. has been deducted from West India and Panama Second Preference, which reflect it in their price of 8½. The First Preference at 9 are ex 6s. dividend. Anglo-Americans moved down a trifle. Telephone descriptions are inactive. Telephone of Egypt 4½ per cent. Debenture came into a little prominence in connection with the rise in most Egyptian industrials, and American Telephone Capita stock eased off a point. New York 4½ per cent. Telephone Bonds, now fully paid-up, stand at 98, which is 2½ premium on the issue price. National Telephone Deferred put on ½. There is no alteration in Marconi shares.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Nov. 23rd.	Closing Quotations Nov. 30th.	Business done week ended Nov. 30th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3¾— 4	3¾— 4	77/6	70/-	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146 —148	145 —147	147½	146½	—1	5 8 10
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	60 — 63	60 — 62	..	..	— ½	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102	100 —101	101	100	—1	5 18 10
3,220,770	Do. do. do. Deferred	Stock	½%	1¾%	1 %	8/-	21⅞— 22½	21⅞— 22½	22	21⅞	..	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	102½	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7⅞— 8⅛	7⅞— 8⅛	..	..	..	4 18 6
2,431,850	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½— 89½	87 — 89	88	87	— ½	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅞— 9⅛	8⅞— 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
80,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	13 — 13½	13 — 13½	..	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	126½—129½	129 —132	131½	129	+ 2½	5 6 1
2,000,000	Do. 5½ % Pref. Stock	100	5½%	5½%	5½%	5½%	84 — 86	84½ — 86½	85½	85	+ ½	4 0 11
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102½	102	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11¾— 12½	11¾— 12½	12 1/16	11¾	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 6
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½— 10⅝	10½— 10⅝	10⅝	..	..	5 8 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13¾	..	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	28½— 29½	29½— 30½	30	29½	— ½	5 18 10
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51 — 53	51 — 53	..	..	..	7 1 2
$41,980,400	Mackay Companies Common	$100	2 %	2½%	4 %	4 %	96 — 98	93 — 95	..	..	..	4 1 8
$60,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	3/16 — 3/16	3/16 — 3/16	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	3/16 — 3/16	3/16 — 3/16	16/-	..	..	6 8
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	3/16 — 3/16	3/16 — 3/16	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 — 108½	107	..	..	5 10 7
3,725,000	Do. do. Def. Stock	100	6 %	5 %	6 %	6 %	120 —122	120½—122½	121½	120½	+ ½	5 2 1
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10½— 10⅞	10½— 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 11/16	..	..	4 8 11
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½%	98 —100	98 —100	98½	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅜	100½	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87 — 89	87/6 — 88½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,883	Reuter's	8	5 %	5 %	5 %	5 %	7⅞— 8⅛	7⅞— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	101 —103	..	..	+ ½	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 7 5
120,000	United River Plate Telephone	6	8 %	8 %	8 %	8 %	6⅛— 7 1/16	6⅛— 7 1/16	7⅛	..	..	5 10 1
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 1/16— 5⅛	5 1/16— 5⅛	..	..	..	4 8 4
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1⅝— 1⅝	1⅝— 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	1⅞— 1⅞	1⅞— 1⅞	1 15/16	1⅞	+ 1/16	5 0 11
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	103½	..	..	3 16 2
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	¼— ⅛	¼— ⅛	..	..	..	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	9 — 9½	8⅞ — 9⅛	..	..	— ⅛	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	9 — 10	8 — 9	..	..	—1	16 13 4
80,000	Do. do. 5 % Debs., Nos. 1 to 1,600 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 7/16— 4 11/16	4 7/16— 4 11/16	91/3	89/4½	..	5 2 4
600,000	Do. 5 % 2nd Pref., 600,001 to 1,800,000	5	..	..	..	..	4½— 4¾	4½— 4¾	..	..	..	5 11 1
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	90 — 91½	90½—92	91¾	90½	..	4 7 5
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	103 —106	..	..	+ 1	4 14 4
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	4 7/16— 4 11/16	4⅜— 4⅝	93/9	92/6	+ 1/16	4 8 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1½— 1½	1½— 1½	19/9	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1½— 2⅛	1½— 2⅛	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅛— 3⅜	3⅛— 3⅜	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½— 3½	2½— 3½	..	..	..	5 14 3
194,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	143 —148	146	144	—1	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	123½	121½	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	106 —109	108½	106½	—1	4 11 9
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102½ —104½	103½	..	..	4 6 2
188,801	British Electric Traction	10	3 %	Nil	Nil	Nil	⅜— 1	⅜— 1	..	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1¼%	2½— 2⅞	2½— 2⅞	55/7½	51/3	..	5 6 8
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	84½	..	..	5 14 11
538,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	58 — 62	60 — 65	6.½	59½	+2½	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6½— 6¾	6½— 6¾	..	..	..	4 11 3
600,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 — 106	..	..	..	4 4 11
804,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,916,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	..	..	..	7 13 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅝— 1	⅝— 1	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
195,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
195,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
127,610	Calcutta Trams, 1 to 127,610	5	8 %	8 %	6 %	4½%	4½— 5	4½— 5	..	..	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4½— 5	4½— 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	101½	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10⅜	10 — 10⅜	..	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	6⅛— 6⅜	..	..	..	4 8 11
900,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,223	Cape F. Trams., 1 to 491,223	1	Nil	Nil	Nil	Nil	7/16— 7/16	7/16— 7/16	5/9	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 1/16— 2 1/16	2⅛— 2⅛	44/9	43/-	..	5 12 9
110,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	4 %	5 %	3½%	61 — 63	61 — 63	..	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	..	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 — 46	..	..	..	5 8 8
1,480,000	City and South London Railway	Stock	13½%	2½%	5½%	14½%	29½— 30½	29½— 30½	30⅜	..	..	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	5 %	¾— 1	¾— 1	..	..	..	15 1 8
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,600 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Nov. 23rd.	Closing Quotations Nov. 30th.	Business done week ended Nov. 30th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
200,000	Dick, Kerr & Co., 1 to 200,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½	4½	4½	4½	100 —103	100 —103	..	..	..	4 7 5
80,000	Dublin United Trams. (1896), 6 % Pref., 1 to 80,000	10	6 %	6 %	6 %	6 %	12⅜— 13⅜	12⅜— 13⅜	..	..	..	4 7 3
99,251	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,251	5	4½	4½	2½	1½	⅜— ⅝	⅜— ⅝	..	..	..	34 5
17,189	Do. "A" shares, 01—017,189	5	4½	4½	2½	2½	1 — 1⅛	1 — 1⅛	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4	4	4	4	66 — 71	66 — 71	..	..	..	5 12 1
67,730	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5	5	5	5	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1½— 1⅝	1½— 1⅝	23/9	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	1½	Nil	¾— 1	¾— 1	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½— 10⅝	10½— 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12⅝	12 — 12⅝	..	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½	4½	4½	4½	5⅛— 5⅜	5⅛— 5⅜	5⅛	5⅛	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½	4½	4½	4½	106 —108	104 —106	..	..	—2	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	10 %	15⅞— 16⅛	15⅞— 16⅛	15⅛	15⅛	..	6 1 3
27,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	1%	Nil	⅜— ½	⅜— ½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	3 %	Nil	1⅛— 2⅛	1⅛— 2⅛	..	..	..	Nil
399,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅛— 2⅛	1⅛— 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜%	2⅜— 2⅝	2⅜— 2⅝	50/-	..	..	18 0 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	66 — 69	68 — 66	63½	..	—3	6 1 3
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	1%	1%	36⅞— 36⅞	36½— 37	37⅛	36⅜	+ ⅛	1 7 0
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	64 — 66	64 — 66	65½	64½	..	4 3 4
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	15½— 16	16 — 16½	16⅛	15⅞	+ ⅛	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅛— ¼	⅛— ¼	..	..	..	6 10 11
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	¼— ⅜	¼— ⅜	15/-	..	..	6 8 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	95	94½	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —128	125 —127	..	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	91½	91½	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ¼	⅛— ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜— ½	⅜— ½	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	86½	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	34½	..	..	5 0 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	100 —101	100 —101	..	..	..	4 19 0
2,800,000	Do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87¾	..	..	5 2 8
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	31 — 33	31 — 33	32	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	6	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 5 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2¼	1⅞— 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	74 — 79	72 — 77 xd	..	..	..	5 1 8

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	..	5½%	5½%	5½%	5½%	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
50,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½— 7⅛	6⅝— 7⅛	..	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	4 13 4
3,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 — 100	96 — 99	..	..	—1	4 0 10
60,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞— 4⅛	3⅞— 4⅛	..	..	..	6 1 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	3¾— 4⅛	3¾— 4⅛	..	..	..	5 6 11
415,795	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 — 101	98 —101	..	..	..	3 19 5
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝— 3⅞	3⅝— 3⅞	70/-	68/1½	..	5 16 2
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —108	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10 — 10⅛	9⅞— 10⅜	10⅛	9⅞	— ⅛	5 1 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜— 12⅜	11⅜— 12⅜	12⅛	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —108	100 —108	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	2 %	..	1¾— 2	1¾— 2	..	..	..	5 0 0
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅞— 3⅛	2⅞— 3⅛	..	..	..	7 8 4
250,000	Do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	98½— 99⅛	98½— 99⅛	..	..	..	5 4 .
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛— 8	7⅛— 8	7¹¹/₁₆	..	..	6 6 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10¹⁵/₁₆	10¹⁵/₁₆	..	..	5 7 10
450,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100¼	100	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	4 13 .
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7 — 7⅛	6⅞— 7⅛	..	..	..	5 13 4
$1,875,000	Kaministaquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	100 —102	101 —103	102½	102	+1	4 17 1
41,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7⅛	7 — 7⅛	7⅛	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝— 2	1⅝— 2	32/6	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜— 6⅛	4⅜— 6⅛	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	92 — 95	93	..	—1	4 4 8
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3⅞— 4⅛	3⅞— 4⅛	..	..	..	5 17 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜— 5	4⅜— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	108 —109	106 —109	..	..	..	4 2 7
248,000	Do. 5½ % Mort. Deben. Stock Redem.	Stock	5½%	5½%	5½%	5½%	85½— 86½	85½— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80½— 82½	80½— 82½	81½	81½	..	6 1 9
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	71 — 75	71½— 73½	..	..	..	4 13 4
$1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	103½	10½	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg.Gold Bnds.	..	..	..	..	5 %	84 — 86	84 — 86	86	85½	..	5 16 3
960,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4⅛	4 — 4⅛	..	..	..	2 15 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	98 — 100	..	..	—1	..
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13½	12½— 13½	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,316	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	6⅛	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅛— 1⅜	1⅛— 1⅜	31/9	29/-	..	4 18 6
100,000	Do. do. 6% Non-Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	5 19 9
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
70,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	7⅛	..	..	5 11 1
175,000	Do. do. 4½ % Deb. Stock Red.	100	5 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	⅞— 1⅛	1⅛— 1⅜	..	..	+ ⅛	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜— 3	2⅜— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	3½%	2½%	2½%	⅝— ¾	⅝— ¾	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅞— 1⅞	1⅞— 1⅞	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅝	⅜— ⅝	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½— 1⅝	1½— 1⅝	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½— 79½	74½— 78½	..	..	..	5 14 8
206,000	Victoria Falls Power Co., Pref. Nos. 1 to 200,000	1	..	..	..	5 %	⅜— ⅝	⅜— ⅝	18/9	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8⅝— 8¾	8¾— 8⅞	8⅞	..	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅝— 5⅛	5 — 5⅛	5⅛	5⅛	+ ⅛	4 1 11

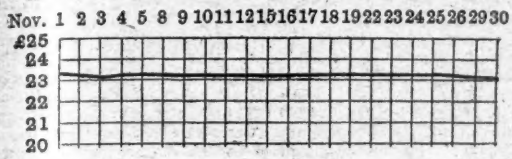
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. xd Interim Dividend.

Bank rate of Discount 5 per cent., October 22nd, 1909

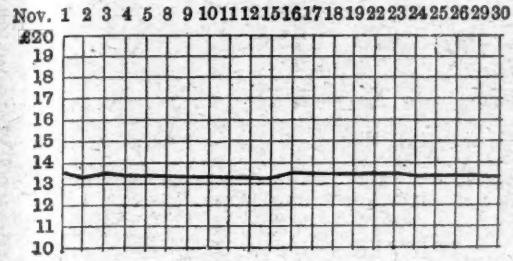
METAL MARKET.

Fluctuations in November.

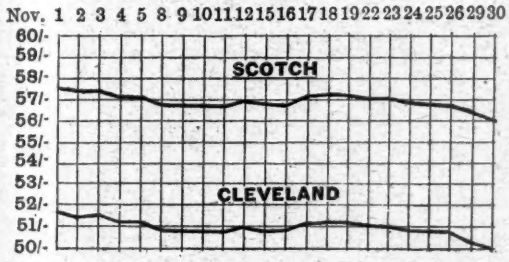
SPELTER (G.O.B's.).



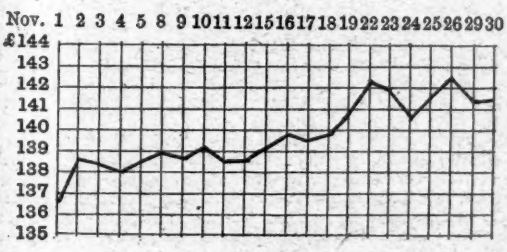
LEAD (ENGLISH).



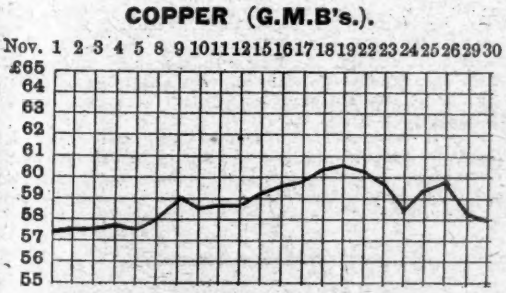
IRON.



TIN.



COPPER (G.M.B's.).



Electric Steel in Canada.—Negotiations have been completed for the erection at Welland, Ontario, of a big electric steel plant by a concern incorporated in Canada under the name of the Electric Steel Co. of Canada, with head office at Toronto. Work on the initial building will begin shortly. The daily output is expected to be 1,000 tons, and a site of 50 acres has been secured. The plant will be ready before the opening of navigation. This will be the first electric smelter in Canada for commercial purposes. The electric smelter which was operated at Sault Ste. Marie two years ago was run by the Government for experimental purposes, under the direction of Dr. Haanell.

ON THE ACTION OF AERIALS IN DIRECTED RADIOTELEGRAPHY.

By R. E. NEALE, B.Sc. (Lon.), A.C.G.I.

According to Mr. J. Zenneck, in the *Physikalische Zeitschrift*, if one considers the bent aerial of Marconi (fig. 1), it is impossible to explain its directive properties if one admits that the earth is a conductor. In fact, in this case the image of the antenna may be regarded as constituted by a second aerial of the same radiating power situated as in fig. 2. At long distances one would imagine that the actions of the two horizontal portions would neutralise

Fig. 1. Fig. 2.

each other, so that only the action of the vertical part remains to be considered ; this is clearly the same in every direction. Hence one cannot thus explain the maximum radiation in the direction A C. By taking account of the imperfect conduction of the earth, however, the explanation of the phenomenon becomes simple.

It is known that in such a case as this the waves E (fig. 3) are not propagated perpendicularly to the earth, but are inclined at an angle α in the direction of motion. It follows from this that Poynting's vector Σ, representing the flow of energy, will be inclined relatively to the earth as indicated, fig. 3.

On the other hand, since this energy emanates from the transmitting aerial, one would expect it to follow the path indicated in

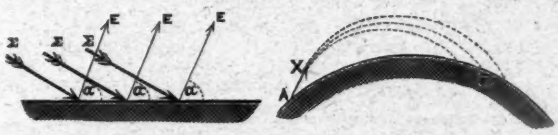


Fig. 3. Fig. 4.

fig. 4, and that, near the sending aerial A, it would have direction A X also inclined at an angle, more or less acute, with regard to the surface of the earth.

Next considering a bent antenna A G H (fig. 5):—According to the above reasoning, which is quite general, the energy emissions in directions A C, A B are represented by the vectors A X A Y, and in order to determine whether the bent aerial has any directive properties, it is sufficient to compare the two energy fluxes so determined.

It is at once evident that for points P, Q sufficiently distant along directions A X, A Y respectively the effects of conductors A G and G H are additive as regards P, but differential as regards Q (Seen from P the currents in the two portions A G, G H of the aerial have

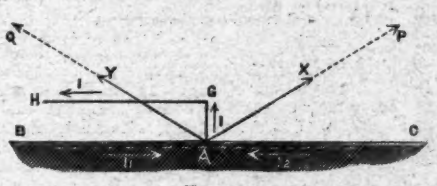


Fig. 5.

the same sense, whereas, seen from Q, they appear of opposite signs.) Now the energy available at P and Q, provided A P and A Q are sufficiently great, is proportional to the square of the field strength (electrostatic and magnetic alternately), due to A G, G H at these points.

The energy available at P is, therefore, considerably greater than at Q (owing to the above additive effect), and hence the range of operation is greatest in direction A C, a result of theory which is perfectly confirmed by practice. So far no account has been taken of earth currents; these currents may be divided as at I_1, I_2 (fig. 5) for the purposes of the present consideration. The action of I_1 is clearly to reduce that of the conductor H G, while I_2 aids the effect of the latter.

Since I_1 is always $> I_2$, the action of earth currents is in general to impair the directive properties of the antenna, and by placing in the earth a conductor, connected to the aerial, and pointing in direction A C, one would expect an increase in the directive power of the system (owing to the relative increase of I_2). This beneficial effect has been experimentally confirmed.

According to the author it is possible to explain the directive properties of systems, other than Marconi's bent aerial, in precisely similar manner. A complete mathematical treatment of the problem is hardly possible on account of the complex conditions obtaining.

THE JUNIOR INSTITUTION OF ENGINEERS.

Summer Meeting in the Midlands.

The distinction of bringing into existence the first local section of the Junior Institution of Engineers has been gained by the members at Birmingham. In recognition of the success of their efforts the Council determined that the week's summer meeting of 1909 should be held in the Midlands, with Birmingham as a central rendezvous, although Leamington was chosen for headquarters.

On the morning of August 14th the official reception by the Mayor of Leamington took place in the Corporation's Royal Pump Room; a tour of inspection was made of the various baths and appliances, &c., which are available, and all the machinery and plant was shown. The high-tension D'Arsonval Gaiffe apparatus naturally attracted great attention. Current for it is supplied by a 13-kw. dynamo, which is also used for electric lighting and power throughout the buildings. The afternoon was spent in a visit to Warwick Castle. A close examination of the celebrated Warwick Vase, which is denied to the ordinary visitor, was much appreciated.

The strictly technical part of the programme opened in Birmingham on the following Monday morning, one division proceeding to Messrs. Gillott & Sons' steel pen manufactory at Hockley, while another visited Messrs. Muntz's Metal Works, French Walls, under the guidance of Sir Gerard Muntz. At the pen works all the processes of manufacture were explained. The slitting is accomplished by means of shearing machines, so delicate in their operation that it is possible with them to place six distinct slits in the width of an ordinary point.

The variety of purposes for which Muntz metal is employed, as exemplified by the numerous articles forming the output of the French Walls works, was most striking. The works cover about 11 acres of land. The original works were a part of the Soho Foundry, where James Watt developed and perfected his first steam engine. An aluminium foundry now forms an important part of the works, castings for motor-cars being produced. As early as 1892 the company determined to concentrate all their power plant in one central electric and hydraulic power station, and clear away all the small separate units. This conversion occupied four years and was based on the most modern practice.

Mr. George Tangye showed his interest in the visit of the Institution to Birmingham by kindly arranging for the members to be shown over the James Watt Museum adjoining Messrs. Tangye's works, and Watt's attic workshop at Heathfield Hall, now the residence of Mr. Tangye. Needless to say the young engineers felt honoured at these opportunities of doing homage to the memory of their great master. The original letter books of the firm of Boulton and Watt were seen, dated 1775, also original drawings by James Watt illustrating different types of early condensing engines, and there were numerous patent specifications, and quaintly worded reports.

The programme for the following morning took the form of an invitation from the Birmingham Local Section to visit works at Redditch and to a complimentary luncheon in the Masonic Hall. The party motored from Leamington, through delightful scenery, and on arrival at Redditch inspected Messrs. Shrimpton & Sons' needle manufactory and Messrs. J. Warner & Sons' fish hook, fishing rod, and fishing tackle works. At the luncheon the chairman of the local section, Mr. F. S. Pilling, M.I.Mech.E., presided. One or two appropriate toasts followed, during which the gratification felt by the members of the local Section in taking part in the welcome of the Institution to the Midlands was expressed, and the acknowledgments of the guests were conveyed by Mr. F. R. Durham, the chairman. The afternoon was occupied in honouring the various objects of Shakesperian interest at, and in the neighbourhood of, Stratford-on-Avon.

On Wednesday the programme comprised a visit to the new buildings of Birmingham University, the works of the Austin Motor Co. and those of the Birmingham Small Arms Co. A fleet of motor-cars, kindly provided by the Austin Co., met the party on their arrival at Birmingham, for their conveyance to the University and use throughout the day, a compliment which was much appreciated. Prof. F. W. Burstall, M.A., head of the Mechanical Engineering Department of the University, received the members in the Great Hall, and, aided by Mr. Kipps, of the Electrical Engineering Department, showed them round, pointing out the very many features of engineering interest to be observed in the equipment of the extensive buildings. The colossal horizontal 300-ton testing machine, made by Messrs. W. & T. Avery, Ltd., naturally attracted considerable attention. Some idea of its magnitude may be gathered from the statement that the maximum length for tension specimen is 28 ft.; for compression, 30 ft.; and span for bending, 20 ft., and that the overall dimensions of the machine are: length, 68 ft.; height, 13 ft.; its width varying from 7 to 12 ft. The wedge grips can take specimens 3¾ in. diameter, or 6 in. by 2½ in. flat. The electrical engineering department is equipped with machines and apparatus of different types, giving both direct and alternating current of various voltages, &c. The power station supplies electricity, gas, and steam to the main buildings, and is also equipped as a heat laboratory.

The section of the party visiting the Austin motor-car works found the inspection of great interest. These splendidly equipped works are capable of dealing with all the operations necessary in the production of the car throughout, not only of the chassis, but of the body and fittings complete. The demand for the vehicles has been such that during the past two years the area of the works has had to be more than doubled.

At the works of the Birmingham Small Arms Co., at Small Heath, the members had shown to them the ingenious machinery used in the manufacture of rifles and cycle components. The workshops contain over 5,000 machines, the bulk of which are self-feeding and semi-automatic, whilst both cycle and gun departments have their own sets of automatic machines for screw making and small components.

Thursday was devoted to Coventry, Messrs. Herbert's tool works and the Triumph Cycle Co.'s Works being visited in the morning, and Messrs. Rotherham's watch factory and the Corporation gas works in the afternoon. The well-known tool works were founded by Mr. Alfred Herbert in 1889. The development of the firm has been continuous and rapid, and at the present time 1,500 men are employed. The various machines turned out are manufactured in quantities, no special tools other than those required on the plant being built.

At the Triumph Cycle Works the members found no difficulty in fully occupying the two hours allotted to the visit; indeed, the contents of the various shops proved so interesting that some reluctance to leave was shown at the conclusion.

The two divisions which had been formed for these visits united afterwards at the Masonic Hall as the guests of the Triumph Cycle Co., with Mr. A. Friedlander in the chair. After luncheon, several complimentary speeches were made, and, dividing again, one party proceeded to Foleshill to inspect, under the guidance of Mr. F. W. Stevenson, M.Inst.C.E., the engineer to the gas department, who designed them, the gas works of the Coventry Corporation, whilst another group were shown over Messrs. Rotherham & Sons' watch factory and motor accessories works. The part that electricity is playing in connection with the manufacture of gas was well exemplified at Foleshill. In the retort house, containing 256 retorts of the horizontal type, were seen two Fiddes-Aldridge simultaneous stoking machines, driven by electric motors. The electric generating plant consists of two sets of 75-h.p. gas engines and dynamos, the power house constituting quite a prominent feature in the works. The watch factory visited dates back to the year 1750, and possesses a high reputation amongst the Coventry works. A fine factory has been equipped for the production of English lever watches of the finest quality and finish. It was pointed out that there are some 1,400 distinct operations in making a Rotherham watch, and some 73 assembling processes. In addition to watches, a large quantity of motor fitments are also turned out.

Messrs. Cadbury Bros.' celebrated cocoa and chocolate manufactory at Bournville was visited on the following morning, Friday. The engineer welcomed the members on arrival, and arranged for the features of engineering interest, of which there are many, to be shown, the power house and refrigerating plant receiving particular attention. It appears that the Institution is the first technical body that has been so privileged, a compliment duly acknowledged by the chairman in speaking at the luncheon to which the members were subsequently entertained by the firm. For the afternoon there were visits to Messrs. Elkington's electro-plating works, and the crystal glass works of Messrs. F. and C. Osler. It may be added that the electro-plating and electro-depositing departments are believed to be the largest and most completely furnished in the world.

On Friday evening the Institution's summer dinner was held at the Great Western Restaurant, and was well attended, a number of local members being included in the gathering. The chairman presided, and amongst the guests were Mr. W. Deakin, President of the Birmingham Association of Engineers; Mr. Kipps, of the University; Mr. R. Kirton, Mr. Thos. Berridge, Mr. F. J. Bywater, and Mr. F. S. Pilling.

On the following morning the electrical signalling apparatus, installed by Messrs. Siemens Brothers at Snow Hill Station for the Great Western Railway Co., was seen, Mr. L. M. Ferreira explaining its construction and operation; and afterwards the Summer Lane generating station of the Birmingham Corporation's Electricity Department was visited under the guidance of the resident engineer, Mr. Kemp.

With this electrical visit the programme for the week closed, leaving impressions of time very agreeably spent, and recollections of many courtesies extended by those through whose ready assistance the arrangements for it had been made. May the Junior Engineers experience many another such summer assembly.

PROCEEDINGS OF INSTITUTIONS.

The Present Aspect of Electric Lighting.

By H. W. Handcock and A. H. Dykes, Members.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, November 25th*, 1909.)

Since we wrote our paper on "Electricity Supply and Metallic-Filament Lamps," two years have elapsed. Extraordinary progress has been made by the lamp makers in the interval. In an installation of 653 lamps, one of the first to be fitted with transformers and 25-volt lamps, in April, 1908, the original 100-volt carbon-filament lamps were replaced by 10-c.p. 25-volt tungsten lamps. Careful note has been kept of the number of lamps renewed since then, from which it appears that, including breakages, the average life has been 1,260 hours, although they are frequently over-run.

In another case, 105-volt lamps of 25 and 32 c.p. were substituted for the original carbon lamps. At the end of 1,083 hours of actual use, out of 980 lamps by various leading makers installed, 70 per cent. were still burning. Individual lamps under test conditions have shown far better results, but the above figures are a fairly reliable indication of what may be expected under ordinary conditions.

The price of wire lamps has also been reduced, and the 100-volt 25-c.p. lamp which two years ago cost 4s. is now listed at 3s. Having regard to the longer life of the new lamps, they are thus but little more expensive than carbon lamps. At least one well-known maker has now succeeded in producing a 16-c.p. 24-watt lamp for 200 volts, which, we are informed, will be on the market very shortly at the price of 5s. We have had some of these lamps in actual use for some months past with very satisfactory results, and we have seen in operation a 10-c.p. 200-volt lamp taking only 15 watts.

In our 1908 paper we ventured to suggest that the effect on those stations relying on a purely lighting load would be disastrous unless some steps were taken to alter the method of charging.

The results of the past two years have only served to strengthen us in our belief that the flat-rate system fails to meet the conditions that now obtain, and that only by the adoption of some system which secures to the undertaking a definite minimum return from each consumer based on the rate at which he contracts to take energy can purely lighting stations be profitably run.

In one station of this kind serving a London suburb, a large proportion of the consumers were "free wired." The price of current was 5½d. per unit for this class of consumer, and a deficiency charge was made in addition of 1d. per unit for every unit by which the consumption was less than 18 units per lamp per annum.

Last year it was decided to allow such consumers to have transformers and metallic-filament lamps, it being stipulated that no lamps of less than 16 c.p. would be supplied. At the same time the terms were altered to a fixed wiring charge of 2s. per annum per lamp installed and 5d. per unit for energy consumed.

The results are instructive. In the case of those consumers who have taken advantage of the new arrangement, it is found that formerly their lamps averaged 12 c.p. and their consumption per lamp installed was 15·6 units per annum.

This gave a revenue per lamp connected (averaging 12 c.p.) of:—

	s.	d.
15·6 units, at 5d. (as for privately wired consumers)	6	6
Meter rent	0	4½
Wiring rental (deficiency charge + ½d. per unit) ...	0	10½
	7	9

Some of them have not been changed over for a complete year yet, but assuming that the uncompleted quarter of the year will bear the same ratio to the earlier part as in previous years, the results due to the change will be—

Average candle-power per lamp, 16.

	s.	d.
Average consumption, including transformer losses, 9 8 units	4	1
Meter rent	0	3
Wiring rental	2	0
	6	4

In spite, therefore, of the wiring rental being increased, in spite of an increase in the illumination of 33 per cent., the inclusive receipts per lamp have fallen from 7s. 9d. to 6s. 4d.

The reduction in consumption is obviously greater in the case of privately wired consumers, on whom no restrictions can be placed as to the minimum candle-power of the lamps they use, and it may be taken as certain that in future the consumption per lamp installed amongst this class will be of the order of 6 to 7 units, whilst in many cases it will fall to as low as 3 or 4.

Even at 8d. per unit a 10-light consumer having a total consumption of 30 units per annum cannot be remunerative.

In the district from which the above instances are taken the price of gas is 2s. 6d. per 1,000 cb. ft., and it was found that in small premises the cost for lighting only, exclusive of cooking, but including the meter rent, averaged 12s. 2d. per gas burner per annum, whilst many were as high as £1.

Surely there is something wrong when, in the same district, electricity yields only 4s. 4d. per lamp and gas 12s. 2d.

In most cases a 25-c.p. 30-watt metallic-filament lamp will satisfactorily replace an ordinary gas burner such as is normally in use. For domestic purposes the 25-c.p. electric lamp is a satisfactory unit of illumination, and if it is more economical than the so-called 60-c.p. gas light, the consumer will take it. Given a proper method of charging, this can be done in such a way as to prove very remunerative to the electric light undertaking.

With the flat-rate system of charging the long-hour consumer at present uses gas. One reason for this is that, owing to the loss made by the electric light undertaking on the short-hour consumer, it is necessary to keep up the price all round, and the competitive illuminant benefits.

Let such a consumer use gas or candles, and let us concentrate our efforts on the long-hour man, who gives us a greater number of working hours over which to earn interest on our capital. At the moment it is generally the other way round, and electricity is given the unremunerative short-hour lamps *because the present tariffs make the cost of long hour lamps too high.*

In the case of the suburban station mentioned above, the standing charges per kilowatt of consumers' demand amount to £17, and the running costs to 0·4d. per unit. Assuming that, under a system devised to attract a different class of consumer, as many as 80 per cent. of the lamps installed come on the peak (the average in the district at present is 30 per cent.), the standing charges per 30-watt lamp would be—

	s.	d.
£17 × 20 × 30 × 0·8 ÷ 1,000 =	8	2
If the lamps were used for 400 hours, the running charges would be 400 × 30 × 0·4 ÷ 1,000 =	0	5
Total	8	7

If they were used for 2,000 hours, the running charges would be—

2,000 × 30 × 0·4 ÷ 1,000 = 24.,

or a total of 10s. 2d. Whether the lamps be used for 400 or for 2,000 hours, therefore, only makes a difference of 1s. 7d.

The difference in cost is so little, and the business advantages, from the point of view both of the station and of the consumer, of a fixed charge are so great that we consider it preferable to make a fixed charge per lamp per annum, irrespective of the number of hours during which the lamps are used.

It obviously does not pay to go to the expense of putting in a meter, providing a staff to read it and keep it in repair, and a staff of clerks to make out the accounts, in order to check such small variations in revenue, more particularly if the relative importance of the standing charges be still further increased by the station supplying the interior wiring.

It may be objected that if there be no meter and no restrictions, the consumer will waste the commodity. If the objection were valid, the present system of water supply in London would be an impossibility. It must not be forgotten, further, that the longer the lamps are used the greater the cost to the consumer of lamp renewals, which thus acts to a certain extent automatically as a check.

As the station is charging per lamp, it must obviously also have some check on the consumer in order that he may not, for instance, substitute a 100-c.p. lamp for the 25-c.p. lamp allowed for. We prefer to do this by using special lamp-holders such that only lamps which are sold by the station or its agents can be used. The consumer who comes back too often for lamp renewals will thus be detected and dealt with accordingly, if it be found that he is wasting current.

Taking the average life of the lamps at 1,200 hours, they would use in that time, say, 36 units per 25-c.p. lamp. This at 0·4d. per unit represents 1s. 2½d., and where the station sells the lamps, the profit on their sale would to a great extent automatically compensate for the wastefulness of any of its consumers.

It is obvious, therefore, that even with a wasteful consumer the station could not lose much, and a meter can, if desired, be put in to check in special cases any consumer suspected of wilful waste. For the reasons above set forth, we believe that all stations having normally low running costs could, with great advantage to themselves, supply the long-hour consumer, who at present generally uses gas, at a fixed charge per lamp per annum, which would be well below what he is at present paying. A fair average price, inclusive of wiring rental, appears to us to be 12s. per 30-watt lamp per annum for a continuous supply, and 10s. per annum for a "dusk to dawn" supply.

This system we call the "contract" system, to distinguish it from the "contract demand" system.

The proposal is, of course, by no means new, but it was practically an impossible one as long as we were restricted to the carbon-filament lamps. The introduction of the wire lamp and the great reduction in the running costs during the past few years have, as we endeavour to show, entirely altered the position. Credit must be given to Mr. Wilkinson, of Harrogate, for being one of the first to appreciate the altered position of affairs, he having introduced into his district the principle of charging small consumers a fixed sum of 11s. per lamp per annum.

A few months ago, in a suburban district where at the moment there were no electric light mains, a small house and a small shop were "free wired" at our suggestion. The living rooms had a single 25-c.p. wire lamp fixed close to the ceiling, which we find gives a very pleasant light in all parts of the room. The smaller bedrooms had a 10 or 16-c.p. light.

A canvasser was sent round the neighbourhood asking the inhabitants to inspect the installation, and on calling they were informed that the electric light company would wire their houses free of initial expense in a similar manner to that before them, and make an inclusive charge of 10s. per lamp per annum to cover the wiring rental and the right to use the lamps as required *from dusk to dawn, and during periods of unusual darkness.*

The canvasser was only employed for a short period, but he secured signed applications for some 2,000 lamps.

We are of opinion that in the future purely lighting stations will, in order to secure the necessary large number of new consumers, be absolutely forced to undertake the wiring of houses and to supply lamps—in fact, to sell *light*, and not electrical energy. By this means any improvement in the efficiency of the lamp will be of benefit to the stations and not, as at present, a loss to them. It is all-important that the cost of wiring should be reduced, and that the cost of services be brought down also. On A.C. systems some form of concentric wiring with earthed outer is not only the cheapest, *per se*, but enables considerable economies to be effected in other directions. Only single-pole switches and fuses are required, and the insulation of the one pole can be abolished or reduced to a very small amount. Since the advent of the wire lamp a large number of concentric wiring installations with earthed outer have been put in, using a double-wound transformer, so that

the supply mains are absolutely distinct and separate from the interior wiring.

The cost of a double-wound transformer is now so low that the saving on the first cost of the lamps is sufficient in most cases to cover it, whilst the saving in renewal of lamps, coupled with the efficiency of the lower voltage lamps, amply suffices to meet the cost of the magnetisation units. Hence the difference in cost of wiring due to the use of one wire instead of two is pure gain.

There is nothing to prevent the whole terrace of houses from being wired from a single transformer fixed on the outside wall of the building, thus making one service supply a large number of houses.

The wiring can, by adopting one or other of the new systems, be brought down to 10s. to 12s. per light, or, say, 1s. 3d. per annum for upkeep, interest and sinking fund.

We have seen above that even where the standing charges amount to £17 per KW. of consumers' maximum demand, a figure which is not likely to be exceeded by many stations, and allowing for 80 per cent of the lights installed being on at once, a 30-watt lamp can be supplied for from 8s. 7d. to 10s. 2d., or, including the free wiring, for 9s. 10d. to 11s. 5d. per annum. It is not likely that the average burning hours will be as high as 2,000, so that it is evident that an ordinary long-hour consumer can be supplied under these conditions for a sum not exceeding 10s. to 12s. per 30-watt lamp. As it is not proposed to put 30-watt lamps in the smaller rooms, a 10s. inclusive charge would in many cases be amply justified.

Particularly with a small alternating-current station, great economies can be effected if a supply be only given from dusk to dawn, the station being shut down during the daytime, and provisions are made under the Board of Trade Regulations whereby consent to this may be obtained. By using internal combustion engines, current can be quickly turned on in the case of fog or unusual darkness, under which conditions a supply is given.

In three districts for which provisional orders have been recently obtained, it is proposed to work on this plan, and the necessary consents have in each case been given by the local authority.

Whilst in most districts it will pay a man with only a few lights to use electricity at the above price, the man with 50 lamps would find the charge too high.

To meet this difficulty, we put in a limit indicator, ask the consumer to switch on the maximum number of lamps he wishes to use at once, and charge him, say, 12s. per 30-watt lamp, calculated on the number to which the limit indicator is set, and 2s. per lamp on the remainder to cover the wiring charges. He thus settles his own diversity factor and is charged accordingly.

This enables him to put in lamps where he naturally would not use them if he had to pay full price on all lamps, and at the same time obviates the absurdity one so often sees, viz., a station providing capital for free-wired lamps which do not even pay the annual wiring charges.

We venture to think that the future of electric lighting lies more especially amongst those consumers whom gas has hitherto claimed entirely as its own.

Comparing the present proposals with the conditions obtaining only three years ago, what do we find? The standing charges of the station and mains per unit of candle-power capacity have, by means of the wire lamp, been reduced by nearly two-thirds; by using double-wound transformers, interior winding becomes single wire instead of double; a main lead consisting of a single No. 18 wire can, at 100 volts, supply all installations of 20 16-C.P. lamps or under; the old double-pole distribution fuseboard is replaced by a single 5-ampere fuse; the meter becomes a memory of the past; a single service supplies a terrace of houses, and electric light commends itself to all long-hour consumers on the score of price independently of other considerations.

Appendixes are added giving typical gas consumers' accounts, and estimates for the capital cost, and working results of small electricity works run on the lines suggested.

Mr. George Wilkinson (Harrogate), who opened the discussion, said he had been struck by the idea that the authors had written the paper from a company's or profit point of view, rather than from the municipal standpoint. In many cases it was true that the new lamp had reduced the station output, but at Harrogate, where they had replaced half their carbon lamps by metal-filament ones, the past seven months' station output was only 2 per cent. down, as compared with the same period in the previous years. During October he had added 622 new lamps, and he, personally, did not fear as to the future. The demand indicator system was too complicated for the small consumer, and the authors had come to the same conclusion as himself, that it was necessary to have a fixed price per lamp. At Harrogate, where this system had been tried, the demand indicator consumer paid on the average 7s. 7d. per lamp per annum, and the flat-rate consumer average 7s. 6d., the fixed-charge consumer was charged 11s. per lamp per annum, based on eight hours per day burning. He thought the wisdom of this charge was proved by the authors' figures. The consumer paid in advance, this being necessary with small houses, and he had only three simple conditions to conform to, viz., that he uses the light only in the evening or when it is dull; that he uses the supply for lighting only; and that the apartments shall not require artificial lighting during the daytime. In connection with his scheme he had had some difficulty in finding a suitable current limiter for from two to six lamps: he was able to get houses wired at 8s. 6d. to 9s. per point, and the tenant paid 5s. 6d. per point for lamp, shade, &c. The house services were now costing from 50s. to 60s. each, including the cost of the limiter, and the rental of the houses supplied was approximately 7s. 6d. per week

Mr. R. Pierce (Cambridge) said he found it difficult to reduce the cost of wiring, including the lamp, below £1 per point. As the total revenue per lamp in many cases was only 3s. (and his company worked at a profit), it seemed that in the case of good consumers, it would be easy to reduce the charges below that stated. The metal lamp certainly brought in new consumers; he had connected 6,000 30-watt lamps recently, due to the cheapening of the light, and considered that the new lamp would be advantageous in the end.

Mr. W. R. Cooper suggested that screw sockets might be used in connection with the authors' proposals, with a view to ensuring that lamps were not changed. There was a great drawback in using only 25 volts on house circuits, in that there was no chance of adding heating appliances, &c. He was sure that metal lamp prices would continue to fall, and it seemed that if it were possible to use 100-volt circuits and overhead transmission in certain districts, it would much facilitate cheap supply. It was a common mistake to use metal-filament lamps with clear globes, as the high intrinsic brilliancy of the filament rendered some protection to the eye necessary.

Mr. C. H. Wordingham said that nothing had been added to Dr. John Hopkinson's paper on charging, which showed that a sliding scale was the only equitable system of charging. He entirely disagreed with the authors' contract demand system, as he considered it wrong to charge a fixed price per lamp. From experience, he knew that there were many difficulties in the working of a contract system, and Mr. Wilkinson's agreement seemed to place too much confidence in human nature. As it was illegal to prescribe any particular burner, he thought this portion of the scheme would have to be reconsidered. He had installed in his own house 25-volt metal lamps, and these had been in use for two years, the first one burning out only last week; it paid well to use transformers and low-pressure lamps. He couldn't agree with the proposal for restricting the supply to certain hours of the day, as it appeared to him a primary consideration to have continuity of supply, as in the case of gas and water.

Mr. A. H. Seabrook said that it was true that various systems were derived from the Hopkinson system of charging, but many engineers had fallen from grace and adopted the flat rate; he quite agreed with the authors' system. He had found that it was impossible to get the shopkeeper, for instance, to light his window till midnight with the flat rate system of charging, but it was quite possible on a contract demand system. The authors' proposals were, however, not sufficiently far reaching, as they neglected the important auxiliary uses of electricity. It was not sufficient to rely on the meter reader or similar employé as a medium for furthering the use of the supply one must send a responsible man round. In the case of Marylebone, which has a properly organised sales department, the new business in the way of adding to and modernising installations amounted to £250 a week, despite the very recent introduction of the scheme.

Mr J. S. Dow said he understood that the low C.P. lamp was not being favoured by people who had used high C.P. lamps. It was right to sell "light," but it appeared to him that the consumer required some guarantee that he got what he bargained for, and it was necessary to provide means of showing that the lighting was what it was represented to be. He understood that in a certain German town they were using small transformers in the lamp-holders, and this would safeguard against changing lamps.

Mr. K. A. Scott-Moncrieff said he had no fear of the ultimate effect of the metal lamp, and he believed in a day load. He thought there was a necessity for a contract demand system for day-load lighting in small towns, while in the evening a metered supply could be given. Regarding the authors' estimate for a 10,000-light plant, he would not care to deal with 240 KW. by three 100-KW. gas engine sets; he also suggested a preference for four-wire three-phase distribution as against single-phase. The paper took him back 20 years with its references to alternating current, house transformers and contract demand.

Mr. F. Risch said the old idea was to cheapen the supply, but now that they had economical lamps there appeared to be an outcry against the small consumer, although the latter could demand both a supply and a meter if he so desired. He thought there was not much in paying more for a supply just because one knew what one was going to pay (a remark which he subsequently discounted by saying that the gas people had done very well out of slot meters). He considered that the small consumer would be wanted in a few years when heating apparatus became efficient, and it was not right to penalise him now.

Mr. Hugo Hirst said there was no reason for panic on the score of reduced output; the big candle-power lamps were very popular and had proved excellent competitors of gas. He thought there must have been a big saving at the stations owing to reduced peak loads.

Mr. Handcock, in replying, pointed out that it was not proposed that the contract system should be used exclusively, but he thought that the metal lamp had brought along new conditions which could be met by some such system of charging as suggested. It was not a question of turning over existing consumers, but of attracting new ones; by small and big consumer were intended short and long-hour consumer respectively, and the latter were sufficiently profitable to enable one to dispense with meters. In considering the possibility of carrying out in practice a contract system, it must be remembered that the E.L. Acts enabled one to enter into an agreement with the consumer, providing he was given the right to a supply on the flat rate system at the price mentioned in the provisional order (frequently 7d. or 8d. per unit). This also applied to the lamp he must use; it also appeared that having signed the agreement determining the lamps to be used, a consumer using a larger lamp would be stealing energy and thus committing a felony.

The President (Dr. Kapp) said that a similar system to the authors' was in use at a small place in Italy, where he had lived, but there was no limiting device, only a meter, which registered if the contract demand was exceeded. This system proved very satisfactory in use, and he hoped the authors' system would be equally so. He understood that they were putting in 10,000 lamps on their system.

Telephones.

By L. E. Wilson.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Manchester, November 16th*, 1909)

Twenty one years ago there were 1,400 subscribers here and about 5,000 subscribers in the metropolis. Now the 103,287 exchange stations on the National Telephone Co.'s system in London as at January 1st this year originate 590,000 calls per day, and in Manchester the number of exchange stations has increased to 20,000, giving 138,000 calls per day.

"Speed" is essentially the telephone engineer's maxim, and a few seconds saved on each call approaches gigantic proportions in the aggregate; consequently even the expressions employed by the operators are regulated, and co-operation, or team-work as it is called, is now used extensively, and reacts favourably on the service.

In spite of the strides made, full advantage is not yet taken by the public of all the facilities a telephone service offers, and this is not due to any technical difficulties. The telephone service is the most rapid, cheapest, and most direct channel for information, and this channel should be open both ways, and the intelligent study of the best method of handling telephone calls is of wide importance; as a rule the subscriber is only alive to the delay *he* actually experiences, and is not interested in any irregularity occasioned by his own methods.

The "engaged number" question is open to great misunderstanding, and a glance at a characteristic curve showing the number of calls which have to be dealt with during the various hours of the day will, in a measure, convey the reason.

The rise and fall in calls, as shown by this curve, indicates a tendency to crowd the day's work into about two hours in the morning and about two in the afternoon, and this tendency is more pronounced in exchanges serving strictly business localities. This characteristic explains many engaged numbers, but engaged calls are chiefly caused by an insufficient number of lines. The subscriber is usually only interested in outgoing calls, and for this reason it is difficult to get the inward traffic recognised, although it is not at all in his interests to neglect his inward traffic. The "engaged number" provides ineffective work at the exchange on some 23 per cent. of the total number of calls; to the subscriber it means lost time and lost or delayed business.

At one time it was customary to allot 50 or 60 subscribers to each operator, a system manifestly far from ideal. To-day the method is to apportion equally the amount of work, relying upon mutual assistance or teamwork to provide for unequal capabilities of the operators, and to prevent an accumulation of calls at individual operators' positions. The work is apportioned on the basis of calls, not lines. To obtain this result, records of calls are taken periodically, and the lines on the switchboard distributed as required. The most important branch of the telephone service is not electrical in character, and the engineer who has persistently devoted his life to the higher side of the art, finds it necessary to acquire also considerable commercial knowledge. The traffic side provides a vast field for intelligent investigation, and the function of the telephone engineer which, a short time ago, was to install lines and build switchboards, is now associated with business and commercial questions controlling the position and size of the exchange, the possible growth, the lay-out of the outside plant and size of the switchboard, distribution of the work, the rate of calling, the character and destination of the calls, and other similar matters which involve the expenditure of huge sums of money.

The introduction of 24 volts pressure on telephone lines brought prominently to the front the question of insulation, and taking 1,000 lines under old conditions, on a wet day 40 per cent. tested under 100,000 ohms; the use of the Sinclair-Aitkin leading-in insulator, which introduces a dry section between the leading-in cable and the outside wire, raised the insulation considerably, and under the same atmospheric conditions, only 23 per cent. proved to be under 200,000 ohms. An investigation of low insulation and the cause sub-divided the responsibility, as follows:—

Outside lines including the leading-in wire ...	37	per cent.
Window terminals	37	"
Office wiring	19	"
Instruments	7	"

After receiving individual attention, no line tested under 7 megohms. It does not necessarily follow that speech transmission was inferior under the old conditions, although with the transference from open to underground wires insulation difficulties almost disappear.

Manchester possessed one of the first paper cable systems; in the first installation there were 153 pairs of wires in a 2½-in. cable, and now cables containing 800 pairs of wire in the same diameter are used.

The introduction of common battery working places all complication at the exchange, where a skilled staff is available, leaving a minimum amount of work for the subscriber to accomplish, with simplified equipment. The less the subscriber has to do, the better for the service, for he is strikingly incompetent as an operator.

The subscriber's instrument has also made real progress, and the general excellence of the design and workmanship makes it difficult to suggest further improvements. The same progress is not so generally noticeable in the domestic or private telephone; the retention of the obsolete types of instrument is unfortunate, and whether this is due to inexperience or the borrowing of ideas, the same errors are perpetuated, and the consequent difficulty of maintenance brings the industry into disrepute.

When attention is once aroused, no doubt the ingenuity and enterprise of the manufacturers will speedily find methods to increase the efficiency of this class of telephone.

A glance at the common-battery standard instrument will show the great improvements and modifications in favour of low maintenance costs, and there is apparently no reason why these features should not be introduced in other types. For small installations it is not always advisable to install a common-battery equipment, but the time has now arrived when the advantages of a common-battery system should be universally appreciated; but unless manufacturers take in hand the necessary educational work, opportunities will, for the time being, be lost and obsolete systems installed.

The advantages a common-battery system offers may be sub-divided under the headings of line, instrument and switchboard:—

(*a*) The common-battery instrument dispenses with the local battery and generator. The simplified instrument consisting of bell, receiver, induction coil and transmitter, with the addition of a condenser, supplies all requirements, and the act of taking off and replacing the receiver gives a definite "call" and "clear" by making and breaking the circuit for direct current from the exchange battery.

(*b*) *Line.*—The line is practically under permanent test, and faults are automatically recorded.

(*c*) *Switchboard.*

1. Responsibility is concentrated to quite 80 per cent. efficiency.
2. Automatic calling is provided.
3. Automatic supervisory signals are provided for both the calling and called subscriber, showing the operator the state of the connections.
4. Uniformity of speech is provided by eliminating the local battery's variation in voltage.
5. Saving in space on the switchboard is of great importance.

In a common-battery system accumulators are usually employed, but there is no reason why suitable primary cells of low resistance should not be used for small plants.

Generally speaking, the telephone has yet to be properly developed in connection with floor-to-floor messages, and there is still preference for needlessly wearing out the staircase, calling heads of departments away from their work, banging doors, and general disturbances; all these objections can be eliminated and an immense saving effected by making it a rule to telephone. The cost of installing a private telephone apparatus may amount to anything from £1 to £8 per station, depending upon the type of installation and the quality of the apparatus, but the cost of maintenance should amount to a small item, provided the apparatus is carefully selected and installed.

It is not unusual for the average number of calls per station to exceed 10 calls per day, and if we consider a typical equipment where 50 instruments are installed this means 500 calls and conversations daily. Reckoning the value of the conversations at the very low rate of ½d. each, it follows that the actual value of the traffic in the installation amounts to no less than £312 10s. per annum, the actual cost of the installation being slightly over £200, and the cost of maintenance about £15 annually.

When we consider, in addition, the great saving in time and improved discipline, it is easy to see how the telephone call may be made a most valuable money saver, but the equipment must be suitable for its work, efficiently installed and efficiently maintained.

Mr. W. Aitken, referring to the status of the telephone engineer, said that it was beginning to be recognised that the telephone engineer's work was very serious, very scientific and full of detail. On a 10,000-line exchange, there would be practically one million spring jacks, which had to be wired up so that there were no faults. The work had to be done in a very perfect way, because faults were so difficult to get at. Mr. Wilson blamed manufacturers for designing 1,000-ohm bell coils and generators with 500 ohms resistance to put in connection with an internal installation with a line resistance of a few ohms. The manufacturers would be very pleased to design apparatus that would be suitable for internal installations, but, unfortunately, the consulting engineers frequently specified certain things which had, of course, to be supplied. The manually-operated multiple switchboard was beginning to be found too cumbersome, and there was a leaning towards automatic systems. With an automatic system they would be able (as the system was a "trunking" or cross-connecting system) to divide the subscribers' lines into smaller units, and an accident to one unit would then only affect a comparatively small number. With regard to arresters, serrated arresters should never be used; the carbon arrester should be adopted. One of the most interesting features of common-battery equipments was the small exchanges. It was the practice for some little time to draw current over the direct line, and feed extensions from the same circuit; current was now supplied over feeder wires.

Mr. Morshead referred to the annoyance of ineffective calls, and spoke of the possibility of a system of storing calls on similar lines to the signalling arrangements employed on the London Underground Railways, whereby trains were dealt with in consecutive order.

Mr. T. Plummer said, with regard to the education of subscribers, he thought it would be of considerable advantage to subscribers if they put a responsible person in charge of the telephone instead of the office boy. The period between 10 and 12 was also the "peak" of the load in connection with trunk calls. At the Manchester trunk exchange, which was the largest in the world, the trunk calls between 10 and 12 a.m. daily amounted to 10,000. Of these 4,000 originated in Manchester, and 6,000 were for Manchester—originating at outside places. Between 11 and 12 this fell off to 8,000, of which the outgoing calls were 3,000 and the incoming, 5,000. The great improvement in the manufacture of paper-core cables was partly brought about by the agreement made in 1905 between the Post Office and National Telephone Co., under which certain standards were laid down—for example, that the combined efficiency of the subscriber's line and junction should not exceed so many miles of standard cable, having a conductor resistance of 88ω per mile of loop and wire-to-wire capacity of 0·054 microfarad per mile, with insulation of not less than 200 megohms between each wire of a pair. This had enabled the company to reduce the weight of conductor in subscribers' cables within a short distance of the exchange to 6½ lb. per mile, which represented the minimum size from a mechanical point of view, apart altogether from its electrical efficiency. In London he believed the National Telephone Co. had at one time a junction exchange, but experience showed that this was not satisfactory, and the arrangement was abandoned, direct junctions being put through from the different exchanges in the metropolis. In the new "City" exchange recently opened by the Post Office in London, there was no multiple on the subscribers' board at all. It was found that the number of junction calls in London formed such a very high percentage—he thought over 80—that the subscribers' multiple was abandoned altogether on the local board. All calls which came into the City exchange had to be transferred on outgoing junctions, or, for subscribers on the same exchange, they went across the room to an incoming junction board, and in that way got on to the subscribers' multiple. There was a fortune awaiting any man who was able to bring out a decent telephone cord. There was no reference in the paper to the very important question of increasing the efficiency of telephone cables by means of inductance coils, as suggested by Pupin. The Liverpool-Manchester 100-lb. conductor air-space telephone cable had been under experimental treatment by the Post Office for some six years past. The cable was 38·5 miles in length, and the first sets of coils, inserted at mile intervals, although increasing the efficiency of the cable, gave rise to trouble through loss of insulation at the leading-in points. About two years ago, however, further experiments were made and improved types of coils were fitted, one with an inductance of 100 millihenrys and the other 133 millihenrys, at 3-mile intervals. The unloaded cable had an efficiency represented by 17 miles of standard cable, whilst the loading at 3 miles intervals had reduced it to about 9 miles with terminal losses, or about 5 miles when the cable wires were extended so as to overcome these losses. The results had been so satisfactory that the new 208-wire telephone cable just laid between Liverpool and Manchester contained conductors of 70 lb. per mile only, and these would be loaded at intervals of about 2½ miles.

Mr. F. D. Latimer said that the diameter of 2·55 in. for a cable having 800 pairs would be quite correct for 10 lb. conductors, not 6½ lb. as quoted; an 800-pair cable with 6½-lb. copper, constructed to comply with the National Telephone Co.'s specification would have a diameter of approximately 2·3 in. The greatest number of pairs with 6½-lb. copper which could be enclosed in a lead sheathing of 2⅝-in. external diameter and with a maximum mutual capacity not exceeding ·08 mfd. per mile would be 1,200. In the City of Liverpool the first cable installed accommodated only 41 pairs of 20-lb. copper; it was the first length of dry-core air space cable laid in Europe, and was run through the Mersey Tunnel in 1891 by the National Telephone Co. for the purpose of connecting Liverpool and Birkenhead. It was still in position and working.

Mr. A. Whalley said that up to five or six years ago practically the whole of the equipment of the common battery exchanges was made abroad, but there were two or three firms in this country, including the owners of foreign patents, which had laid down plant, and everything could now be made in this country. The Post Office was to be credited with a large share of this encouragement of British industry. It appeared for the moment, however, as though the manufacturing capacity had overtaken the demand, partly because of bad trade, and partly, perhaps, because the National Telephone Co.'s property would be taken over by the Post Office in two years or so, and the company's expenditure was consequently curtailed. The number of employés engaged in this country in making telephone exchange equipment and instruments was between 3,000 and 4,000, and to keep them properly occupied orders should average about £10,000 per week, or at the rate of £500,000 per year. He was afraid that not much more than one-third or one-quarter of that amount might be ordered next year according to present signs. The standards adopted had set a high mark of quality and efficiency, and every important manufacturer in this country could now supply to these standards. While in America they had an output of telephonic apparatus many times greater than ours, no universally accepted standard had so far been adopted there. The delays in using the exchange telephones were, perhaps, more than anything due to the office boy controlling the instrument. In the States it appeared the custom for every man in a responsible position in any business to have a telephone on his desk, and anyone could get through to him direct at once. As regarded the use of private telephones in works, &c., the annual cost should be below £2 sterling per instrument per annum. If the saving of time to each employé provided with a telephone was only 5 per cent.—and it would be much more—this meant that a wise business maxim was that in every large office or works, each employé who was paid £100 a year salary should have a telephone on his desk.

Mr. A. R. Bennett, in a written communication, said that the first telephone exchanges to be kept open all night in this country, and, so far as he could ascertain, in the world, were the Douglas Street and Hillhead Exchanges in Glasgow, and the date was January 1st, 1881. The Glasgow continuous service was a success from the first night, and led to a notable increase in the subscribers to the Commercial system. Probably London was the last place of importance in the kingdom to give an all-night service. As late as 1895 new switchboards for many thousand subscribers were fitted in Berlin and other German cities without any provision being made for night service; and other Continental countries were just as backward. Without doubt many lives and much property had been saved by the existence of night telephones.

Mr. S. J. Watson (chairman) said that if users would pay greater attention to the loss of time which must occur through their own methods, all subscribers would benefit by the improved service.

Mr. Wilson, in reply, said that the inter-communication telephone of above 10 lines was not a complete success. In his mind, there was no doubt that the automatic switchboard would come, and probably develop as a feeder to large exchanges. With regard to calls being stored up, the principle applied to telephone calls means that one's line would be engaged, and nobody else could get one whilst waiting, which was a feature not to be encouraged. Oxford Court served its purpose; primarily it was a trunk exchange, and small exchanges not requiring many junctions always had connections to this central exchange, so if the direct junctions were engaged this channel was available. He thought that an air-space cable was in use before 1891. It seemed particularly unfortunate that the telephone industry should suffer because of the artificial conditions brought about through the Post Office arranging to buy a rapidly-growing business several years ahead.

THINKING IT OUT.

By J. H. W.

Engineers are for ever contending against innumerable small difficulties—commercial, mechanical, electrical or chemical—and some big ones. Very often these difficulties are tackled in a rather haphazard fashion, or else shelved until some member of the staff happens to suggest a way out of them, and the writer ventures to think that few people have a systematised method of mentally attacking them. A certain fitting is costing too much to make, or a particular machine is frequently coming in for repair. Have you a mental process ready to deal with the matter methodically and logically? If not, the present article is an attempt to supply one, or, at any rate, the outlines, which can be filled in to suit individual requirements.

The first step in tackling any problem systematically is to ascertain *exactly* what is wanted, and to *write it down*. This sounds very obvious and very easy, but it is by no means so easy to get all the requirements into a few short sentences, and this writing down will be found of immense value in crystallising one's ideas and getting at essentials.

The commercial requirements should be considered first. These always involve cost of manufacture, efficiency and durability, and may also include questions of appearance, compliance with Home Office or other regulations, and so on.

Next come the mechanical necessities; strength, weight, direction, range and speed of moving parts; questions of friction and lubrication; accessibility and means of take-up or renewal of wearing parts; any special qualities such as water-tightness or resistance to corrosion, and so on. It is impossible here to do more than hint at the most likely points. Each problem will suggest its own requirements, but make sure that while nothing essential is omitted, the list contains no unnecessary condition. Prof. Unwin used to employ a neat phrase in specifying the requirements of a design. He would say that to obtain such and such a result it was "necessary and sufficient" to do so and so. This is the thing to aim at, in a nutshell.

Next may be considered the electrical conditions to be complied with, if it be an electrical problem; conductivity and current-carrying capacity, insulation, magnetic flux, and so on. Finally, any chemical or special necessities of the case must be taken into account. Now, having prepared the specification, so to speak, to which you must work, the next

step is to find a solution of the problem satisfying all the conditions or as many as possible. Here is where originality and experience come in. The latter is a question of time and opportunity; the former, though possessed in very varying degree by different people, can undoubtedly be cultivated and increased by use. Still, sometimes that idea we are searching for is very elusive, and little can be done to hasten its approach beyond a steady concentration of thought on the problem. A close study of the methods by which other people have attacked the same difficulty is often useful, if only as showing what to avoid; and sometimes the best points of several faulty designs, skilfully combined, will give the desired solution. On the other hand, there is a great danger of repeating the mistakes of others, of following in the rut; and this is, above all things, to be avoided. As an example of this, one may recall the early types of motor-cars, which were utterly spoiled because their designers slavishly followed the lines of horse-drawn vehicles. Always apply first principles to a problem, and let the design stand on its own merits without reference to past work, though this by no means implies that past experience should not be utilised to the utmost. The fact, however, that the difficulty under consideration has cropped up shows that past experience in that particular direction has been found wanting, and therefore a new line must be struck out. It is often very helpful to consider a similar sort of problem in quite another department. For instance, in considering the method of delivering current to a travelling crane, the methods used in electric railway and tramway work for delivering current to the motors by trolleys, ploughs, and so on, would be worth studying.

No doubt a number of solutions to the problem will present themselves, only to be quickly rejected as not satisfying some condition or other. However, let us assume that finally a scheme reveals itself which seems hopeful. It must be compared with the list of conditions to be satisfied, to see if it fulfils them all as far as possible, and if it passes this test it must be closely examined to see if it contains anything superfluous, or whether it can be simplified in any way. The essence of good design is simplicity, and if your scheme takes a complicated and roundabout way to achieve its end, you may be sure there is a better one lurking round the corner. In this connection it is a very useful habit to get into the way of *seeing* things mentally. Sketches will help, but you must have the thing fairly clear in your mind before you can make them, and the more vividly you can visualise the thing and see it working, the easier it will be to simplify and perfect it. And not only must one visualise the finished article, but also every step in its manufacture and assembly. Here again, if the processes involved are at all complicated, it is a very good plan to write down a list of the operations in order. This will often suggest a few modifications which will save some machinery or otherwise cheapen production.

The suggestions contained in this article may seem to deal chiefly with questions of design, and mainly to concern draughtsmen, but they are applicable, *mutatis mutandis*, to any sort of engineering problem, from the lay-out of a power transmission plant to the method of allocating to each job the time and material used; from the handling of a 50-ton electric steel furnace to the disposition of the lamps in a room. The big jobs can look after themselves. They are always carefully gone into—there is too much money involved for it to be otherwise; but the small things, that undue voltage drop here, that inefficient drive there, that second setting on the machine when, perhaps, one could be made to do, that item in the stores account which has been rising slowly for months past, for no obvious reason, or that squad of labourers who do not seem to be getting through the work they should—these are the things that often make the difference between loss and paying prices, and, therefore, need to be tackled systematically.

These remarks are not addressed to experienced engineers who may be taken to know and practise already the methods advocated, but to junior engineers, foremen, and all the rank and file of the trade. You are the people who come against the difficulties most intimately, and can best study their causes. Get into the way of thinking out problems systematically for yourselves; it pays. There are very few firms nowadays who do not encourage and advance those who show originality in overcoming difficulties and effecting small economies.

Finally, a few more words as to the trial and failure of new ideas. There is almost always a certain amount of prejudice and doubt to be overcome when any new thing is introduced. We all know the old foreman who has been 20 years with the firm, and strongly resents changes of any sort. Apart from this, a new method or a new tool requires use and practice before it will yield results fairly comparable with the old way. See that your new scheme gets fair trial over a reasonably long period, and do not be disheartened if all does not go smoothly at first. Probably all that is needed is a little humouring, or, perhaps, a few trifling alterations. Should the scheme, however, after patient trial, prove a failure, the sooner it is admitted the better; but even so, it will not be without value if the reasons for the failure are carefully studied. Tackle the problem afresh in the light of the new knowledge you have thus acquired.

THE POSSIBILITIES OF THE STEAM TURBINE.

[COMMUNICATED.]

In view of the great developments in steam turbine construction during recent years, it is very surprising that the possibilities and limitations of the steam turbine should still be so vaguely understood by a large proportion of engineers.

A few years ago many new designs were produced, for each of which was claimed some particular constructional or other advantage, with a steam consumption at least equal to that obtained by the Hon. C. A. Parsons in his well-known design, which was the first successful commercial machine, and which still maintains the lead in steam consumption under similar conditions of steam and vacuum.

Out of all these there are only two main designs left at the moment which offer any serious competition with the standard Parsons design, namely, the compound impulse type, with only one row of moving blades per stage, introduced by Prof. Rateau, and the Curtis compound impulse design, with more than one row of moving blades per stage.

The attractive features of these two designs are due to their possessing fewer possibilities of operating troubles, by reason of the greater clearances permissible over the blade tips.

The most important alteration the Rateau design has undergone is the increase in blade speed, which reduces the number of stages required, and enables them all to be got into one cylinder instead of requiring two cylinders, as in the original design. This point, in conjunction with the improvement in detail construction, has enabled it to attain a steam consumption closely approaching that of the Parsons type.

The Curtis design has had the four rows of moving blades per stage reduced to two per stage, and the number of stages increased from two to four or five. It has been stated that an improvement of 30 per cent. in the steam consumption is obtained with the latest design over that obtained with the machines built to the early designs.

The only objection raised to the Parsons design comes from the operating standpoint, and is due to the fear inspired by the small clearances required over blade tips and on dummy strips to maintain a low steam consumption. Experience has now proved this fear to be somewhat unnecessary, for many machines have been in long and continuous commercial service without any such troubles. The attractive features of large clearances, however, continue to induce great efforts to be made to bring the steam consumptions of the impulse types down to those obtainable with the Parsons design. With the view of combining the advantage of large clearances at the high-pressure, and consequently high-temperature end, and the better steam consumption of the Parsons, combination designs of Curtis at H.P. and Parsons at L.P. end have been introduced. Combinations of Curtis and Rateau or Zoelly have also been tried to

improve the consumption, but as the best results of any pure impulse design have hardly reached that of the Parsons, it was only to be expected that the combination types would not be successful, although they may possess some mechanical advantages over the Parsons. As the steam consumption is of the first importance, however, the small clearances of the Parsons design will continue to be accepted as long as it maintains the lead in that respect.

Devices have been tried to improve the steam consumption of impulse turbines, which involve running with small clearances at various points. The introduction of small clearances at any point, however, nullifies the advantages possessed by the large blade tip clearance, and creates the same fear of possible trouble as with the Parsons, and, in addition, the likelihood of even worse results.

Should the standard Parsons design come into contact from any cause, it clears itself in the majority of cases with only a slight increase in steam consumption as the result, or, at the worst, with the loss of a few rows of blades, while even then the machine will continue to operate. Should an impulse turbine have the shaft seize up where it passes through the diaphragms, it is immediately placed out of service, while if packing devices are used, which will rub away without seizing, then the improved steam consumption due to them is lost, even if no other damage is done by the vibration set up.

The sole feature which has enabled the turbine so largely to supplant the reciprocating engine for driving electrical generators is due to the great increase in the size of the units now adopted. For 500 to 1,000-KW. sets the double-acting quick-revolution engine still remains a strong competitor, as regards both cost and steam consumption, while below 500 KW. the engine continues to hold its own. Above 1,000 to 1,500 KW. capacity the turbine holds the field. It is only when large capacities are required, and consequently large quantities of steam are being consumed, that the turbine gains the lead.

A high rate of R.P.M. is also imperative to the successful application of the turbine, and no design has so far been produced which has increased the field of application by reason of its lower speed. Special designs of air compressors, fans and centrifugal pumps have been produced for direct connection to turbines, but for the speeds and powers required for the direct driving of factories and the other manifold uses of a prime mover the turbine is hopelessly handicapped. The advantages gained in driving large generators, however, will prove of great service to the electrical industry, because the reduction in the cost of generating current, made possible by its use, will help materially to increase the number of motor-driven plants installed in place of the small steam or gas engine.

In marine work the turbine is limited to those vessels which require large powers to propel them at a high rate of speed, and in which a compromise can be made with the propeller R.P.M.

All these types of turbines have now had considerable and lengthy tests in commercial service, and there is no immediate prospect of any great strides forward being made.

Improvements in blading proportions and manufacture may slightly improve the steam consumption, but there is absolutely nothing in sight to substantiate the dreams and anticipations of the many people who, a few years ago, talked of the reciprocating steam-engine being shortly found only in a museum.

NOTES ON TRADE ABROAD.

Constantinople Telephones: A Noteworthy Success.

In our issue of October 8th, under the sub-title "Good Thing for Somebody," we emphasised the importance of the "very substantial and valuable concession" that was in the market in Constantinople for the provision and working of telephonic service. It is gratifying now to learn from dispatches to the daily Press that the concession has been awarded, by the Commission specially appointed to consider proposals, to Mr. Herbert Laws Webb, of London, whose name needs no introduction to our readers, and who is above all things known for his zeal in the interests of the progress of telephony—subject to the confirmation of the Turkish Ministry of Finance. It is stated that Mr. Webb was representing a very strong combination, composed of influential gentlemen connected with the National Telephone Co., the Western Electric Co., of Chicago, the British Insulated and Helsby Cables, Ltd., and the French Thomson-Houston Co. We congratulate Mr. Webb and the British-American-French group upon this success, and hope that information of the final approval will soon be received. We are encouraged to hope that the other electrical concessions which are shortly to be given out for Constantinople will also be as discreetly sought after, ensuring that, at any rate, a fair proportion of the resultant business will come to English factories. Constantinople, a city of nearly a million inhabitants, has neither electric lighting nor electric tramways, and both may be regarded as inevitabilities of the early future. Indeed, the position of the electric lighting concession is such as to demand the immediate attention of those who desire to bid for it. In a report recently sent home to the States by a Consul, it was stated, "The prospectus of an electric light plant . . . . will soon be prepared. The present antiquated horse-car system of the city has a franchise which will be in effect for a long time, but the company is willing to sell it, and a company which will change the system to an electric one will make money. The city being badly split up into several sections, Galata, Pera, and Stamboul being the three important divisions, a good tramway system would be popular. Every day there pass across the bridge between Galata and Stamboul at least 10,000 people. The length of the bridge is about one-third of a mile. Between Galata and Pera there is also a heavy daily passenger movement." Reference to earlier issues of the REVIEW will show that some months ago Sir Clifton Robinson and others were interesting themselves in the tramway matter.

From what we have said it will be observed that the Turkish Government, in awarding the telephone concession, are carrying out the wise policy recommended by Djavid Bey, the Minister of Finance, of entrusting to concessionaires the development of such enterprises, recognising that, with concessionaires of wide experience and high financial standing, the investment of the necessary capital and the application of the best engineering skill can be relied upon for the development of important services. We hope that the telephone success will give our manufacturers a great thirst, which will know no denial, for these lighting and traction concessions. Would not a combination of firms concerned with different sections of the electrical manufacturing industry, engineered probably on somewhat similar lines, be feasible in these cases also?

Electrical Notes from India.

One of our Indian correspondents writes as follows:—

"*Metal-Filament Lamps.*—These have now become popular on the Indian market, and a rapidly increasing business is being done. Native users are not slow to realise the undoubted economy resulting from their use, and this triumph of economic lighting can be seen in the smallest bazaar shops of Bombay, Calcutta and Madras, where it almost completely eclipses its older rival. Makers of metal-filament lamps have scarcely as yet, in spite of their persistent assurances to the contrary, produced a high-voltage lamp which is entirely reliable. Large consignments of 225-volt lamps have been imported, but the percentage of breakages during transit and very soon after being put on circuit is beyond all reason, and consequently many importers are shy of touching them, and users, too, are very sceptical. The less fragile 110-volt lamp, of various makers—English, German and American—is making great headway, and it is difficult to say at present which pattern is most popular. A belief holds ground that the last word has not been said yet in metal lamps, and that they will become not only cheaper, but more solid, reliable and sturdy and be able to stand the rough handling both in transit and of local native workmen.

"The comparatively high rates for energy, consequent on heavy establishment charges and other expenses of supply companies, has up to now militated against the general use of electric light and power by the middle-class and poorer native, who keenly discusses his probable monthly expenses

before installing electricity. In one city, where the maximum-demand system of metering obtains, it was discovered, in some instances, that consumers, who had occasion to use all their lights and some temporary additions on festive occasions, simply piled crushed ice all round their maximum demand indicators to keep their registered demand normal.

"*Bangalore.*—This very go-ahead city of modern ideas is (says our contributor) an excellent example of what good street lighting can do towards improvement. Many miles of principal streets, both in the cantonments and in the native city, are lighted on the G.E. Co.'s (America) system of series low-voltage constant current metal lamps, energy being obtained from the Cauvery Falls power station many miles away. Most of the public buildings, hotels and private residences are electrically lighted, and every encouragement is held out to local manufacturers and machine users to adopt electric drive.

"It is not improbable that within a reasonable time the narrow-gauge railway connecting Mysore and Bangalore cities, a distance of 78 miles, will be converted to electric traction, as there is still a vast amount of water-power available at the Cauvery Falls. As the lion's share of the Mysore State electric equipment work has, up to the present, gone almost exclusively to America, it is to be hoped that if the above railway traction proposal becomes an accomplished fact, the work will be done by an English firm.

"*Nepal.*—An electrical engineer has been specially appointed from home on a three years' engagement to superintend the erection of the new hydro-electric scheme to light the capital, Khatmandu. This contract was arranged personally by H.H. the Maharajah through the India Office, when he was in England in 1908."

Bolivian Conditions.

In our "Consular Notes" to-day, there appear some interesting facts sent home by British Consul at Sucre, regarding affairs in Bolivia. An electric lighting plant was set going at Sucre a year ago, which was a year later than the municipality required under the contract, but the story of the difficulties that led to the delay, and the waiving of the penalties, is interesting reading to those who have dealings with some of these undeveloped parts of the earth. The same report contains much valuable information concerning the general trade conditions. Our Consul says that no new openings can be expected for British trade, until British exporters send out more travellers, or establish a British firm on the spot:—

> The men who carry the samples get the orders, and the German travellers are so over-whelmingly superior in numbers to the British that they get orders even for articles of exclusively British manufacture. If they can substitute German articles for them they do so, with British labels and imitation British trade marks, and only when this is impossible do they import from the United Kingdom. As regards the establishment of British commercial houses, it may be contended that the business is too small to warrant such procedure, but the Germans and others do it, and are said to make clear profits of from 10 to 20 per cent. The business can be started on the basis of an exclusive privilege of some staple article. Such houses generally have branches in Potosi, which is on the same line of transport, and where the business can be combined with the buying and exporting of minerals. This in itself is a profitable business, besides being of importance in connection with imports in that it tends to relieve the importer of the trouble result from a fluctuating exchange. Besides the competition of the German element in the district who, of course, favour German goods, British traders should be well prepared beforehand to cope with the serious competition of United States firms. The language spoken in the country is Spanish. In the banks, commercial houses and other places, English or French may, more often than not, be understood, but if an answer is required it will be given in Spanish. Ninety per cent. of all catalogues, price lists, &c., not written in Spanish are, for all intents and purposes, practically useless in the district. Packages and bales should be made with a maximum weight of 150 lb., for mule traffic, so that one package may be placed on either side of the mule, making a total load of 300 lb. Machinery and other goods which do not admit of being restricted to this weight, have to be transported on carts and should be timed to arrive at the ports of landing not later than the middle of November or not earlier than May, as the rains make the roads impracticable for carts during the intervening period. As regards the packing of goods, especially in the matter of breakable or damageable articles, for the interior of South America, such of the British packers as have experience in the matter know their business too well to need any hint, and exporters would be well advised to employ none but those packers. Neglect in this respect is the cause of many goods arriving in a useless state, the cases being reduced to matchwood and the contents lost. It must be borne in mind that on an inland journey, which may last several weeks, cases are exposed to a fierce tropical sun, heavy rains and numerous shocks by being dropped from the mule's back on unloading or by crashing against protruding rocks in the narrow passes.

It is true that the volume of electrical trade in Bolivia is not great, but it is a land which is very rich indeed, and as transportation facilities increase it will abound in opportunities, as we showed in one of our articles on "Neutral Markets of the World" (see ELECTRICAL REVIEW, June 8th, 1906, Bolivia).

RAPID CABLE TELEGRAPHY.

WE were recently privileged to enjoy a private view of the rapid system of handling telegrams which has been evolved by the Anglo-American Telegraph Co. in connection with their Stock Exchange traffic. The necessity for this will be understood when we explain that, owing to the difference in time between New York and London (five hours), the American exchange opens at 3 o'clock by London time, and the London exchange closes at 4 o'clock. There is, therefore, but one hour during which business is in progress in both exchanges simultaneously, and it is of the first importance that intercommunication between the two centres shall be as rapid, reliable and unfettered as it can possibly be made, in order that the transaction of business may be facilitated to the utmost.

Accommodation in the neighbourhood of the Stock Exchange is necessarily scarce and costly, and therefore the Anglo Co. formerly occupied a small office in a neighbouring building. Recently, however, the manager, Mr. J. H. Carson, succeeded in obtaining from the Stock Exchange authorities accommodation within the Exchange itself, and developed the system to which we have referred to the highest pitch attainable.

The space at the disposal of the company has been divided into a decoding room and an operating room. The former is occupied by the decoding clerks of the firms utilising the special service—necessarily a small number, on account of the limited space available. From this room pneumatic tubes convey the messages direct to the floor of the Stock Exchange or to Shorter's Court.

In the operating room the receiving and transmitting apparatus is arranged for duplex working, with Morse recorders, and communicates through repeating stations with Valentia, Ireland, whence the cables run to Newfoundland and on to New York. In the ordinary course one set of apparatus is in use, the other being held in reserve, with operators at all four instruments.

The procedure is very simple. The telegrams are short, being prices as they fluctuate on the New York Exchange; all free matter in the preamble is cut down to the lowest limit, and the address in most cases consists of a single letter. As each message is received and written down by ear (the recorder being in circuit only for the purpose of providing a permanent record) it is *instantly* handed to an attendant and passed rapidly through to the decoding room, whence it proceeds within a few seconds to its final destination. Two receiving operators are necessary at each instrument, as the loss of time in changing the carbon with which a duplicate is made would introduce delay—the instant that one message is through, the second operator commences taking down the next message, and this goes on continuously. In ten minutes we saw 200 messages come into the office—a splendid record of 20 per minute—and there seemed to be no prospect of the slightest relaxation of this high speed, which, we take it, is by far the quickest rate of receiving ever recorded. At the same time, of course, messages were being transmitted to Valentia on the same wire, and at the same speed.

To attain to this high-water mark of efficiency has naturally involved a great deal of organisation and experiment that does not appear on the surface, and Mr. Carson is to be congratulated on this unique demonstration of the capabilities of the trans-Atlantic cable system. It is

interesting to note that no extra charge is made for the messages transmitted on this system.

In the course of our visit we were also taken round the main operating room of the Anglo-American Co., in their new building at 63, Old Broad Street. From this office special wires radiate to all parts of the country, and to the Continent; the main lines are worked with the Wheatstone apparatus. Rapidity of communication is the watchword of the company, and to this end every possible means is utilised. High-speed automatic punchers, for example, are installed at certain points of the system, and though faulty at first, have now attained a degree of efficiency which enables Mr. Carson to speak highly of their performance. Manual punching, however, at the terminal stations is preferred to the keyboard instruments now on the market, though the company will not fail to take advantage of these when they have reached a satisfactory stage towards perfection. Every message is carefully checked to ensure accuracy.

Comparing the splendid work done by the cables with the fitful performances of the wireless trans-Atlantic system, one cannot but feel that the epoch when the latter will displace the former—if ever—must be far in the future. Wireless in its own sphere is unexcelled; but in long-distance working it is not yet in the running with cables.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,403. "Improvements in and connected with electrically-driven centrifugal drying machines." W. A. MACFARLANE. November 15th.

26,422. "Improvements in electrical switches." H. W. COX. November 15th.

26,461. "Improvements in and relating to telephone mouthpieces." C. W. CLOUGH. November 15th. (Complete.)

26,465. "Improvements in electric signalling apparatus." SIEMENS & HALSKE AKT.-GES. (Date applied for under Sec. 91 of the Act, December 7th, 1908, being date of application in Germany.) November 15th. (Complete.)

26,466. "Improvements in rectifiers for high-tension alternating electric current." SIEMENS BROS. & Co., LTD. (Siemens & Halske A.G. Germany.) November 15th. (Complete.)

26,470. "Improvements in and connected with electrical storage batteries." V. DE KARAVODINE. November 15th.

26,486. "Improvements in method of and apparatus for controlling automatic electrically-operated lifts, hoists and the like." R. F. BAERLOCHER. November 15th.

26,492. "Improvements in the wiring of electric circuits." H. LEITNER and W. H. EXLEY. November 15th.

26,510. "Improvements in the generation of electrical power for transmission, and speed regulation for electrically-propelled ships, railway and road locomotives, trains or similar vehicles and the like." W. P. DURTNALL. November 15th.

26 530. "Improvements in or connected with casings for electrical appliances." MAVOR & COULSON, LTD., and S. M. MAVOR. November 16th.

26 553. "Improved attachment for telephone receivers." L. SIEGENBERG, JUN. November 16th.

26,554. "Improvements relating to safety devices for use with fuse boxes and switch boxes." W. WHITE. November 16th.

26 570. "Improvements relating to electric tumbler switches." C. W. DENNY. November 16th.

26,577. "Improvements relating to electric telegraph systems and apparatus." W. JUDD, B. DAVIES and A. R. HARDIE. November 16th.

26,608. "Improvements relating to electrical machines." W. A. PRICE. November 16th.

26,641. "Improvements in and relating to electrical convectors or heating apparatus." S. H. PENNING. November 17th.

26,649. "Improved electrolyte for use in electric batteries." NEW IGNITION SYNDICATE, LTD., and W. J. L. SANDY. November 17th.

26,683. "Improvements in galvanic batteries." J. E. PRESTON. November 17th.

26,687. "Improved method and means for actuating electro-mechanical fog signals for railways." G. LOWTHIAN. (Application for Patent of Addition to No. 2,973 of 1907.) November 17th. (Complete.)

26,706. "Improvements in or relating to electric arc lamps." KORTING and MATHIESEN AKT.-GES. (Date applied for under Sec. 91 of the Act, November 23rd, 1908, being date of application in Germany.) November 17th. (Complete.)

26,739. "Improvements in attaching metallic filaments to the conducting wires of electric lamps." H. LEITNER. November 17th.

26,758. "Device for cleaning incandescent electric globes or lamps." G. GARTY and P. M. H. POTTER. November 18th.

26 779. "Improvements in and connected with telephone transmitters." K. O. LEON and C. C. LEWIS. November 18th.

26,807. "Improvement in current collectors for vehicles propelled electrically from an overhead conductor and travelling without a track." W. KOHLER. (Date applied for under Sec. 91 of the Act, May 3rd, 1909, being date of application in Germany.) November 18th. (Complete.)

26 808. "Improvements relating to vehicles electrically propelled from an overhead conductor and travelling without a track." W. KOHLER. (Date applied for under Sec. 91 of the Act, May 4th, 1909, being date of application in Germany.) November 18th. (Complete.)

26,831. "Improvements in sanitary telephone transmitters." M. Y. CALCUTT and E. J. BROWN. November 18th.

26,844. "Improvements in electric furnaces." A. HELFENSTEIN. November 18th. (Complete.)

26,845. "Improvements in electric furnaces." A. HELFENSTEIN. November 18th. (Complete.)

26 873. "Improvements in boxes for containing mantles used in incandescent gas lighting, incandescent electric lamps, and other fragile articles." A. H. STEVENSON. November 19th.

26,898. "Improvements in the distribution of electric energy." A. E. TANNER and E. A. CLAREMONT. (Date applied for under Rule 13, April 8th, 1909. An invention comprised in Application No. 27,858 of 1908, dated April 8th, 1909.) November 19th. (Complete.)

26,899. "Four-way and off electric light switch." E. BOURNE. November 19th.

26,907. "Improved current collector for electrically-propelled vehicles." W. KOHLER. (Date applied for under Sec. 91 of the Act, October 4th, 1909, being date of application in Germany. Application for Patent of Addition to No. 26,947, 1909.) November 19th. (Complete.)

26,929. "Improvements in or relating to electric resistances." H. KORBER. (Date applied for under Sec. 91 of the Act, November 30th, 1908, being date of application in Germany.) November 19th. (Complete.)

26,941. "New and improved rail for either electrically-driven or horse-drawn tramway lines." H. C. GIRLING. November 19th.

26,948. "Improvements relating to commutator bars in connection with the armatures used in dynamos and motors." J. HEYS. November 20th.

26,984. "Improvements relating to the regulation of electric circuits such as the field windings of dynamo-electric machines and the like." W. STANSFIELD and J. J. HATT. November 20th.

27,036. "Improvements in or relating to apparatus for electrically-controlling machine tools." A. J. BOULT. (Felten & Guilleaume Lahmeyerwerke Act.-Ges., Germany.) November 20th. (Complete.)

27,038. "Improvements in apparatus and relating to apparatus and method for generating alternating currents." J. L. MILTON. (Date applied for under Sec. 91 of the Act, January 30th, 1909, being date of application in United States.) November 20th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

WIRELESS ELECTRIC SIGNALLING. R. A. Fessenden. 20,005. September 28rd.

HANGER FOR ELECTRIC TROLLEY WIRES. H. Schutte. 22,631. October 26th.

PRIMARY ELECTRIC CLOCKS. T. J. Murday. 22,819. October 27th.

TROLLEY WHEELS OR COLLECTORS FOR ELECTRICITY. E. M. Schollenberger. 22,951. October 28th. (Date applied for under International Convention, October 28th, 1907.)

ELECTRIC SWITCH ARRANGEMENTS. M. B. Field and Ferranti, Ltd. 23,515. November 3rd.

AUTOMATIC EXCHANGE TELEPHONE SYSTEMS. F. Hildebrand. 23,888. November 7th.

DETACHABLE LOCK FOR BAYONET-CATCH ELECTRIC GLOW LAMP HOLDERS. C. F. H. Bayly. 26,205. December 4th.

CEILING ROSES AND THE LIKE FOR USE IN ELECTRIC CIRCUITS. F. G. Bazell and R. B. Verney. 27,729. December 21st.

CONSTRUCTION OF REGULATING ELECTRIC SWITCH. Veritys, Ltd., and W. G. Pipkin. 28,092. December 24th.

GALVANIC BATTERIES. S. Benko. 28,297. December 28th.

CONTROLLERS FOR ELECTRIC MOTORS. R. E. Baerlocher. 28,351. December 29th.

ELECTROLYTIC DEVICES SUITABLE FOR USE AS, OR IN THE CONSTRUCTION OF, SWITCHES, RECORDERS, METERS AND OTHER APPARATUS. W. B. Thorpe. 28,561. December 31st.

DEVICE FOR AUTOMATICALLY SWITCHING-IN AN AUXILIARY SOURCE OF ELECTRIC CURRENT ON FAILURE OF THE MAIN SUPPLY. Chloride Electrical Storage Co. and A. Imbery. 16,985. July 21st.

APPARATUS FOR PRODUCING HIGH-FREQUENCY ELECTRIC OSCILLATIONS, MORE PARTICULARLY APPLICABLE TO WIRELESS SIGNALLING. R. A. Fessenden. 18,420. September 2nd. (Date applied for under International Convention, September 10th, 1907.)

WIRELESS SIGNALLING. R. A. Fessenden. 20,426. September 28th. (Date applied for under International Convention, October 10th, 1907.)

METHOD OF AND MEANS FOR ELECTRICAL WIRING. A. E. Lamkin and T. R. Nunwick. 23,413. November 3rd.

ELECTRICALLY-OPERATED TRAMWAY OR LIKE POINTS. G. H. Butterworth and E. Veevers. 23,546. November 4th.

MAGNETIC POWER TRANSMISSION GEAR. R. Lecoche. 23,796. November 4th. (Application for Patent of Addition to No. 15,780, 1906.)

ELECTRIC CURRENT INTERRUPTER. T. McClelland. 23,870. November 7th.

CONSTRUCTION OF ELECTRIC CIRCUIT BREAKER. Veritys, Ltd., and W. B. Pipkin. 25,333. November 25th.

BOXES FOR JUNCTIONS, TESTING, INSPECTION OR FUSE PURPOSES AND THE LIKE, FOR USE IN CONNECTION WITH ELECTRICAL CABLES AND THE LIKE. H. R. Mansfield. 28,397. December 30th.

1909.

FITTINGS FOR ELECTRIC INCANDESCENT LAMPS. F. W. Suter. 430. January 7th.

CONTROL OF ELECTRICALLY-OPERATED CLUTCHES. F. M. Green and Daimler Motor Co. (1904). 695. January 11th.

TELEGRAPHY AND TELEPHONY BY MEANS OF HERTZIAN WAVES. F. J. Chambers. 2,330. February 1st.

ELECTRIC TIME SWITCHES. W. E Richter. 2,605. February 3rd.

MACHINES FOR SHEATHING ELECTRIC CABLES WITH METAL SHEATHING. Witzenmann. 3,257.

SECONDARY ELECTRIC CLOCKS. J. Neale and E. Powell. 3,437. February 11th.

CONSTRUCTION OF TELEPHONE AND SWITCHBOARD LAMP-JACKS. M. S. Conner. 4,630. February 25th.

ELECTRIC INDICATORS. A. Whalley. 5,040. March 2nd.

RECEIVING INSTRUMENTS FOR ELECTRIC TELEGRAPHY. T. Clark. 6,525. March 18th.

CONTROL OF ELECTRICALLY-OPERATED ELECTRIC SWITCHES. A. S. Cubitt. 7,113. March 24th.

APPARATUS FOR PERIODICAL INTERRUPTION OF ALTERNATING ELECTRIC CURRENT. L. J. B. Drault. 9,502. April 21st. (Date applied for under International Convention, April 23rd, 1908.)

ELECTRIC OSCILLATION DETECTORS. G. W. Pickard. 10,772. May 6th. (Date applied for under International Convention, March 25th, 1909.)

CONTROLLERS FOR POLYPHASE ALTERNATING-CURRENT INDUCTION MOTORS. B. G. Lamme. 14,579. June 22nd.

TROLLEY WHEELS OR COLLECTORS FOR ELECTRICITY. G. Krebs & Gustav Krebs and Co., Ges. 15,895. July 7th.

ELECTRIC CONTACT BREAKERS FOR USE IN IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES AND THE LIKE PURPOSES. J. A. Schneider. 17,486. July 27th.

SAFETY APPARATUS TO BE USED WHENEVER HOLES ARE BORED FOR BLASTING OPERATIONS AND WHEN FIRED BY DETONATION THROUGH AN ELECTRIC CURRENT. R. Harris. 225. January 5th.